# Aging & Rehabilitation

## An Interdisciplinary Research Seminar Series


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# Schedule

- January 9th, 2006 – May 22nd, 2006
- Mondays, 12:00 – 1:00
- Location: UF HPNP Building, Room G101
- Cyber Seminar:
  - VA RORC Conference Room, Commerce Building Downtown
  - VA BRRC Nursing Home Care Unit Conference Room (first floor)
  - UF Brooks Center Conference Room, Jacksonville (904) 306-8977

# Themes

- Basic Science
- Clinical Science
- Outcomes / Health Policy
- Behavioral and Social Research
- Cutting Edge / New Research

UNIVERSITY OF FLORIDA

department of Clinical and Health Psychology
College of Public Health and Health Professions

# Cognitive Training with Older Adults

Michael Marsiske, Ph.D.

# Cognitive improvement "in the news"

## Health and Behavior

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Posted 8/17/2005 6:38 PM Updated 8/18/2005 4:13 AM

### Want a sharp mind for your golden years? Start now

By Marilyn Elias, USA TODAY

Knowing they'll need a nest egg for later years, sensible middle-aged adults may put their stockbroker on speed-dial and keep 401(k) updates handy.

Michele Rubin, 46, changed her diet to improve her memory.

By Bob Riha Jr., USA TODAY

But how about building a "cognitive reserve" account their brain can draw on at older ages when memory problems are most serious?

It's more than just a clever idea. Animal studies and rapidly growing human evidence suggest that adults might be able to delay or prevent severe cognitive decline, says Molly Wagster, who directs research on normal brain aging at the National Institute on Aging. "There are no guarantees yet, but it's really looking like some of these things could work."

USA TODAY

# Cognitive improvement "in the news"

## Lifestyle May Be Key to Slowing Brain's Aging

By Rob Stein

Like many Americans sliding into middle age, Kimberly McClain started worrying that her memory was beginning to slip.

"It was little things. I couldn't remember what I had for dinner the night before. I had to check to make sure I'd paid the insurance that month. I'd walk into a room and realize I had no idea why I was there," said the Los Angeles marriage counselor, who is 44.

A large body of evidence indicates that people who are mentally active throughout their lives are significantly less likely to suffer senility, and a handful of studies have found that mental exercises can boost brain function. Elderly people who go through training to sharpen their wits, for example, score much better on thinking tests for years afterward. The minds of younger people who drill their memories seem to work more efficiently.

The Washington Post

# Objectives

- 1. Summarize findings regarding cognitive training outcomes with older adults
- 2. Describe the effect of major moderating variables (education, cognitive status) on training outcomes, and
- 3. Evaluate transfer of training findings from cognitive training to everyday functional outcomes.

# The goals of cognitive training research have changed

- A central premise here is that the goals of this research have evolved—as much for public health reasons as because of the goals of investigators—to examining cognitive interventions as prevention and rehabilitation approaches
- The problem:  The empirical research has not caught up with the rhetoric

# Marking the territory

- Before we think about intervening, what is normal aging?

# Mayo's notion of a "Cognitive Continuum"

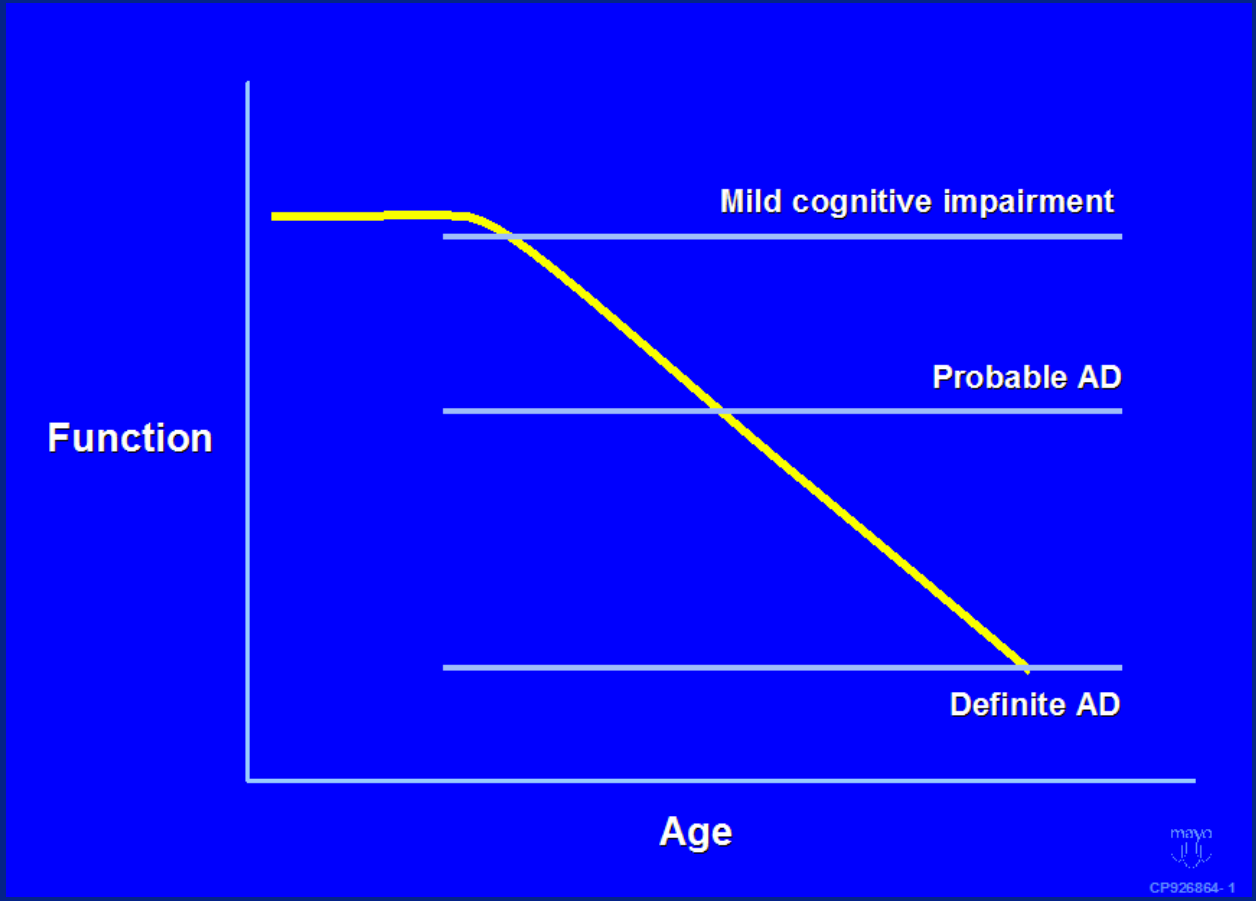
Normal

Mild Cognitive Impairment

Dementia

Source: Peterson

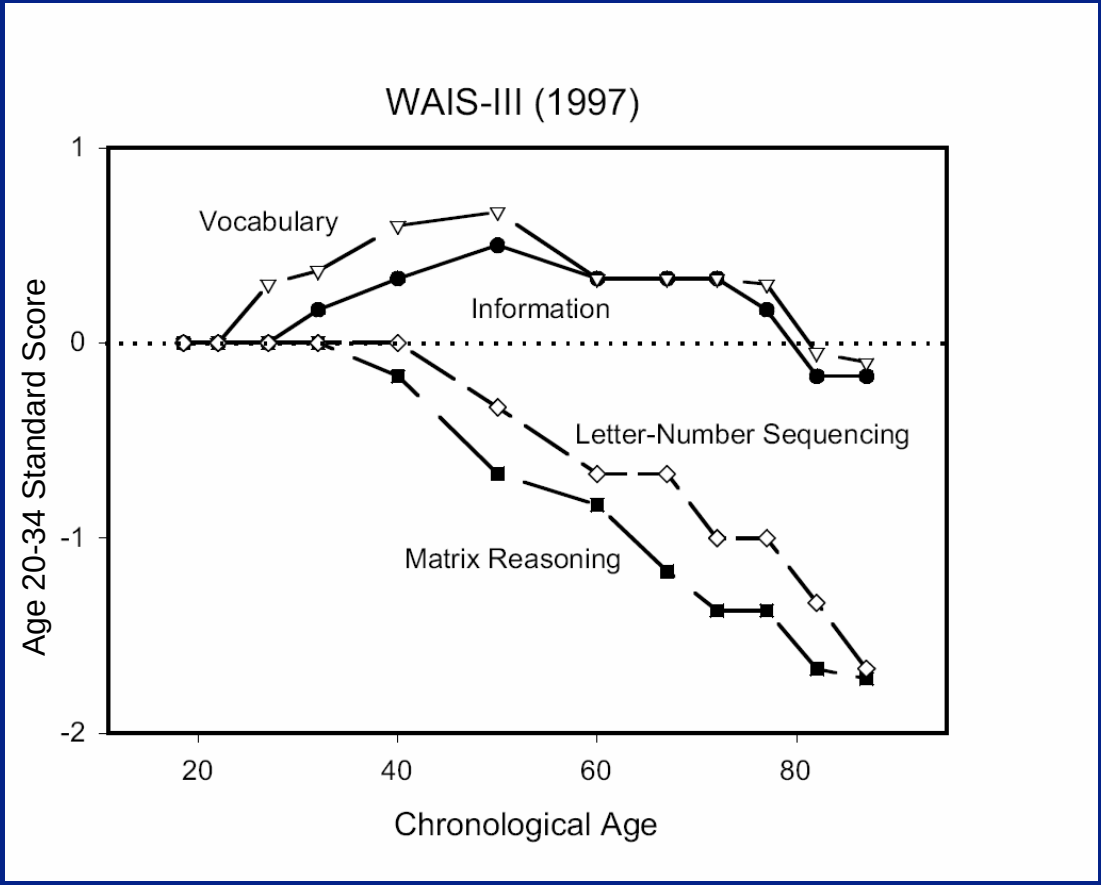
# Mayo's Cognitive Continuum



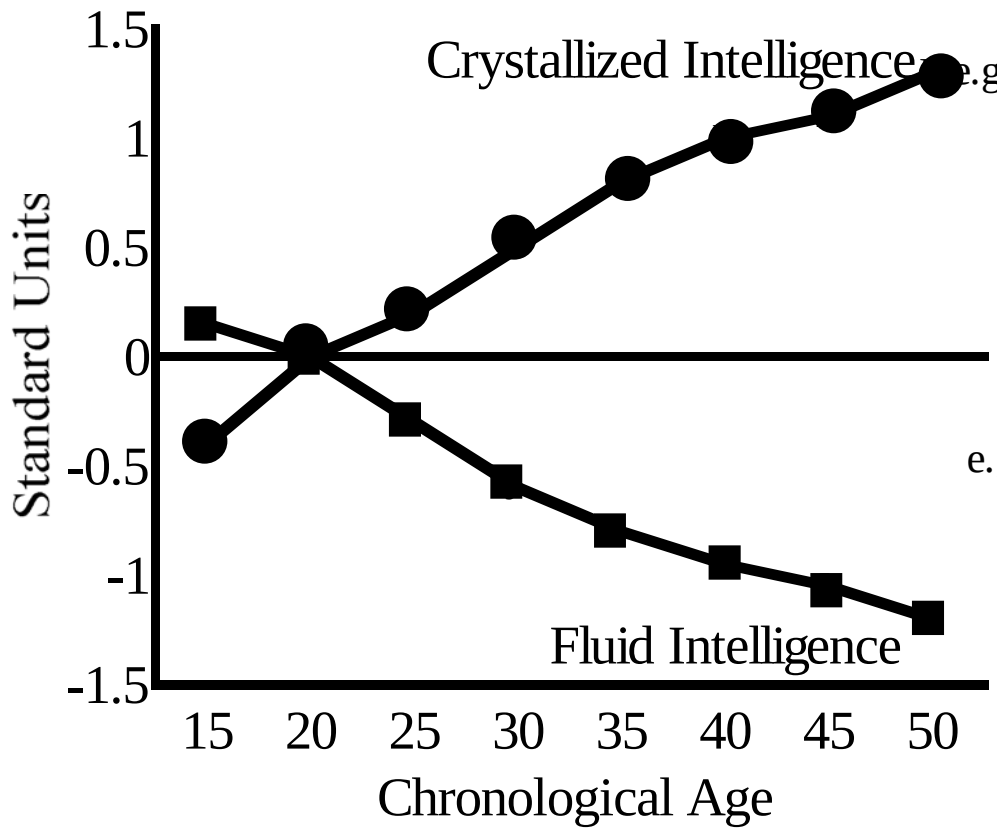
# Normal cognitive changes

# This has come to be called “The classic pattern of intellectual aging”

- This is a dissociation in cross-sectional trends that has persisted in just about every major investigation since



# Horn and Cattell (1967) used this distinction as the basis of their "fluid" and "crystallized" model of intelligence




e.g., Verbal ability
Everyday knowledge
Wisdom
Job & leisure expertise

e.g., Reasoning
Memory
Speed
Spatial Ability

# Risk factors for cognitive decline

**Physical/health predictors**

- chronic conditions (e.g., Schaie, 1996)
- CVD and blood pressure (e.g., Hertzog, Schaie, & Gribbin, 1978; Gruber-Baldini, 1991; Schaie, 1996, but distinction between "complicated" and "uncomplicated" hypertensives; see also Deary et al., 1998; Elias et al., 1998; Schultz et al., 1989, Prouty Sands & Meredith, 1992; Haan et al., 1999)
- arthritis (e.g., Schaie, 1996)
- neoplasms (e.g., Schaie, 1996; distinction between malignant and benign)
- diabetes (e.g., Schaie, 1996, Haan et al., 1999)
- lung function (FEV/Peak Flow)(Swan et al., 1992; Albert et al., 1995)
- depressivity (e.g., Carmelli et al., 1997)
- (APOE)-e4 (e.g., Graves et al., 1999,Haan et al., 1999; Jonker et al., 1998, but not in Small et al., 1998, Brayne et al., 1996)
- olfaction, hearing and vision (Schaie, 1996; Graves et al., 1999)

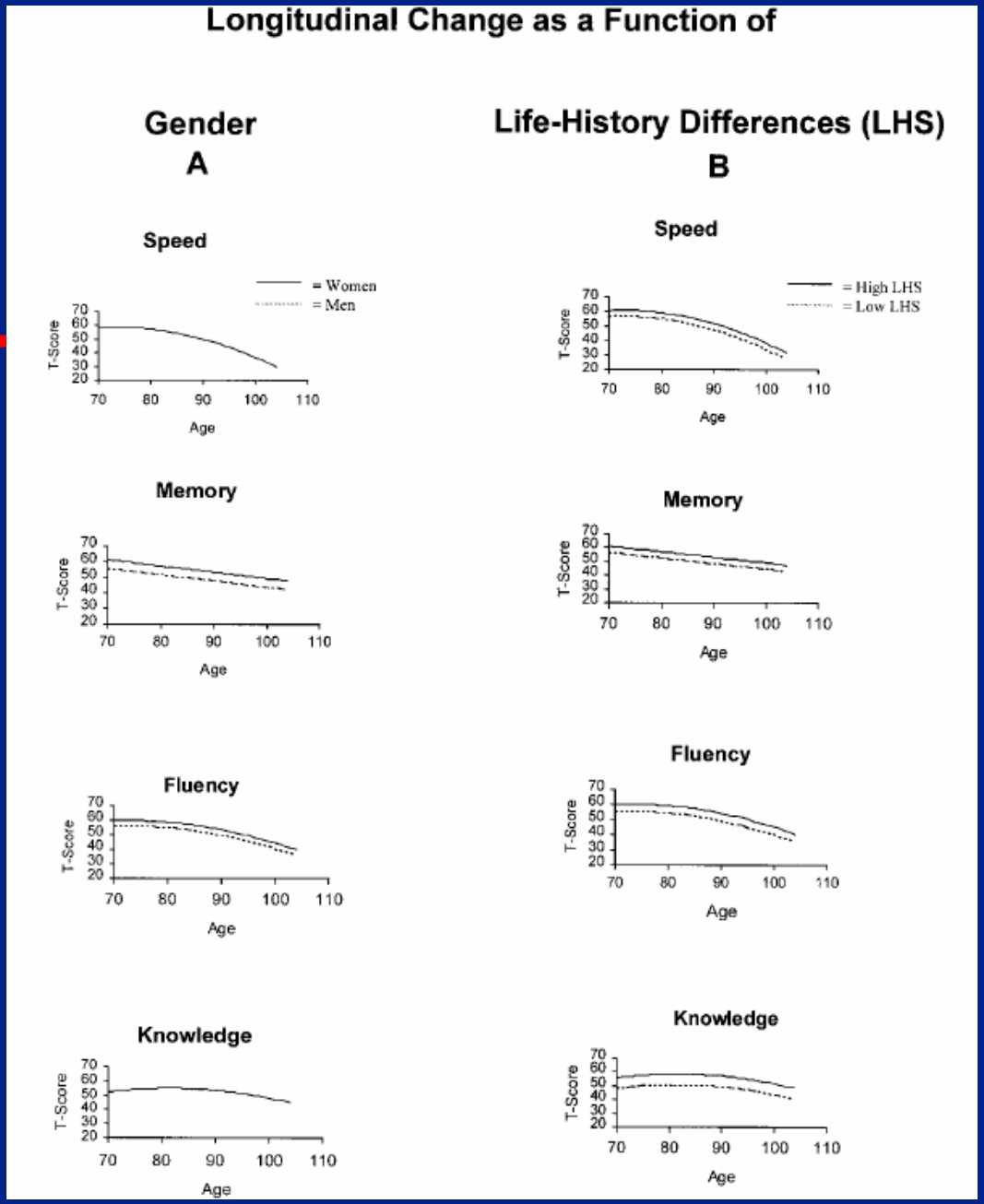
# Risk factors for cognitive decline

**Social status/acculturation predictors**

- physical activity (Albert et al., 1995; Carmelli et al., 1997, but not in Whitfield et al., 1997; Hultsch et al., 1998)
- intellectually challenging activity (e.g., Hultsch et al., 1998)
- engaged lifestyle (e.g., Gribbin, Schaie, & Parham, 1980; O'Hanlon, 1993; Schaie, 1996)
- occupational complexity (Schmand et al., 1997; Schooler, Mulatu, & Oates, 1999)
- educational attainment (many studies; e.g., Schaie, 1996; Albert et al., 1995; seems to be conditioned by age of participants and type of task: e.g., Carmelli et al., 1997; Schmand et al., 1997; Hultsch et al., 1998; as well as the 'crystallized" nature of the task: e.g., Arbuckle et al., 1998)

# Is age kinder to the initially most able? (Source: Singer et al., 2003)

- Generally, no! More educated persons seem to decline from a higher baseline, and *level* differences persist through the life course. But everyone seems to decline at the same rate.
- This also seems to be true for ethnic group differences.



# Are there functional impacts of these declines?

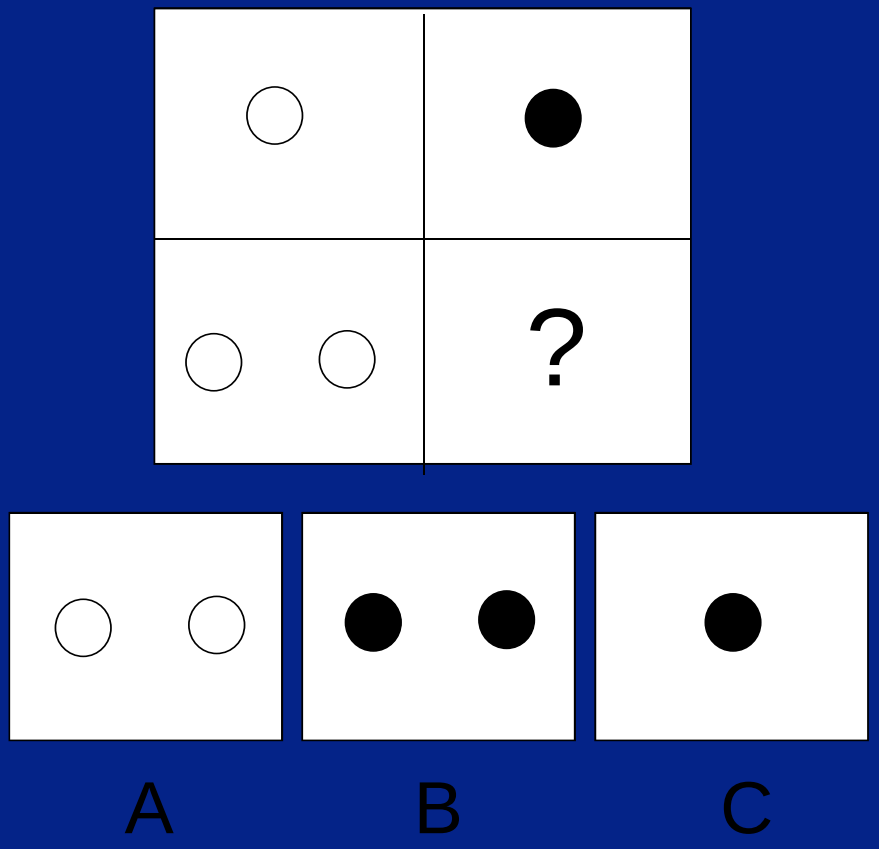
# What are the common targets of intervention?

# Domains of focus

- Major foci:
  - Reasoning
  - Memory
  - Attention/speed of processing
- Since the 1970s, a large body of research has investigated the modifiability of several kinds of reasoning in adults aged 65 and older

# What is reasoning?

- **Figural Relations**: Identify the pattern in the upper box, and pick which of the answer choices would best complete the question mark.



# What is reasoning?

- **Inductive Reasoning**: Identify the pattern among the series of letters, and then decide what would come next in the series

a m b a n b a o b a ?

1. a
2. b
3. o
4. p
5. q

# What is memory?

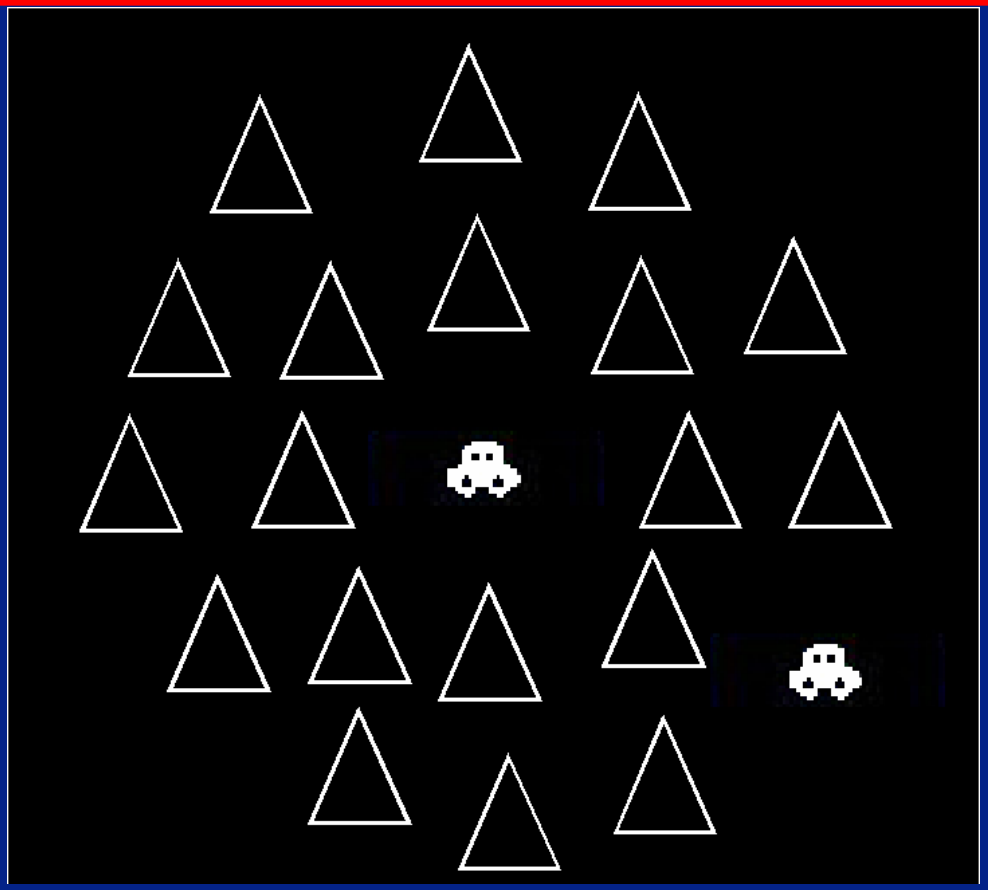
- **One common task: Episodic list recall**

desk
ranger
bird
shoe
stove
mountain
glasses
towel
cloud
silver
lamb
gun
pencil
church
fish

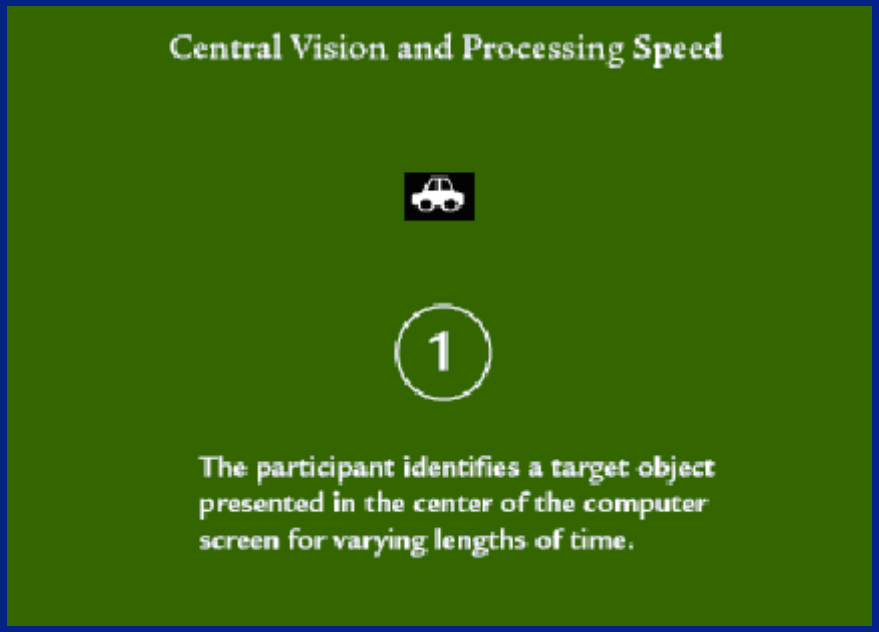
# What is “attention/speed of processing”?

- There are many definitions
- One that we’ll consider today is ‘Useful Field of View’

# Useful Field of View

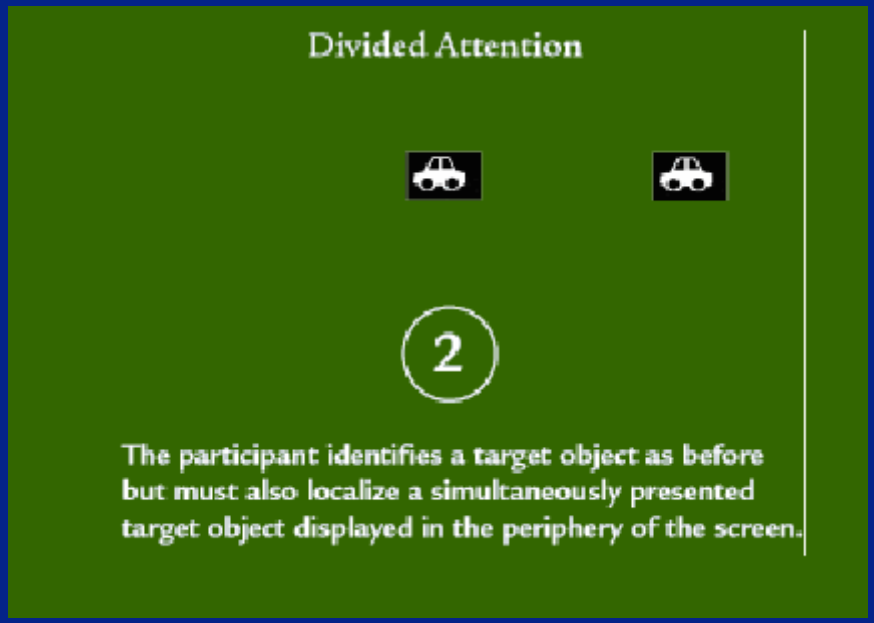


# Useful Field of View



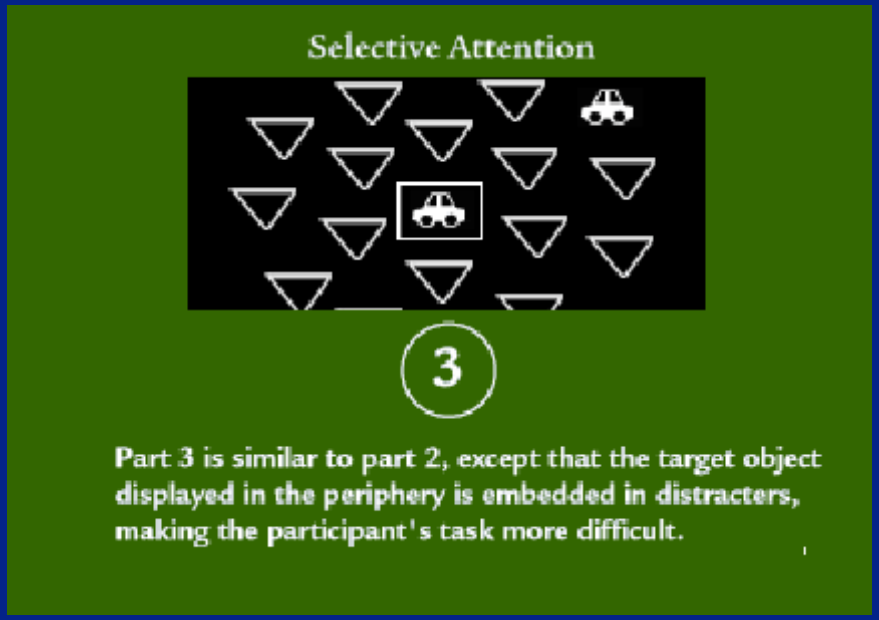

"Speed". This test determines the fastest speed at which you can identify whether the central target (which flashes quickly) is a car or a truck. The minimum (best) score is 16 ms; the maximum score is 500 ms—because the system TIMES OUT. If it takes you longer than half a second, the system quits on you.

# Useful Field of View




"Divided attention". This test determines the fastest speed at which you can identify whether the central target (here: car) AND identify the location of a "peripheral" target (here: say 2 o'clock). Again, scores reflect the fastest speed at which you achieve 75% accuracy, and will range from 16 ms (limits of the system) to 500 ms (time out).

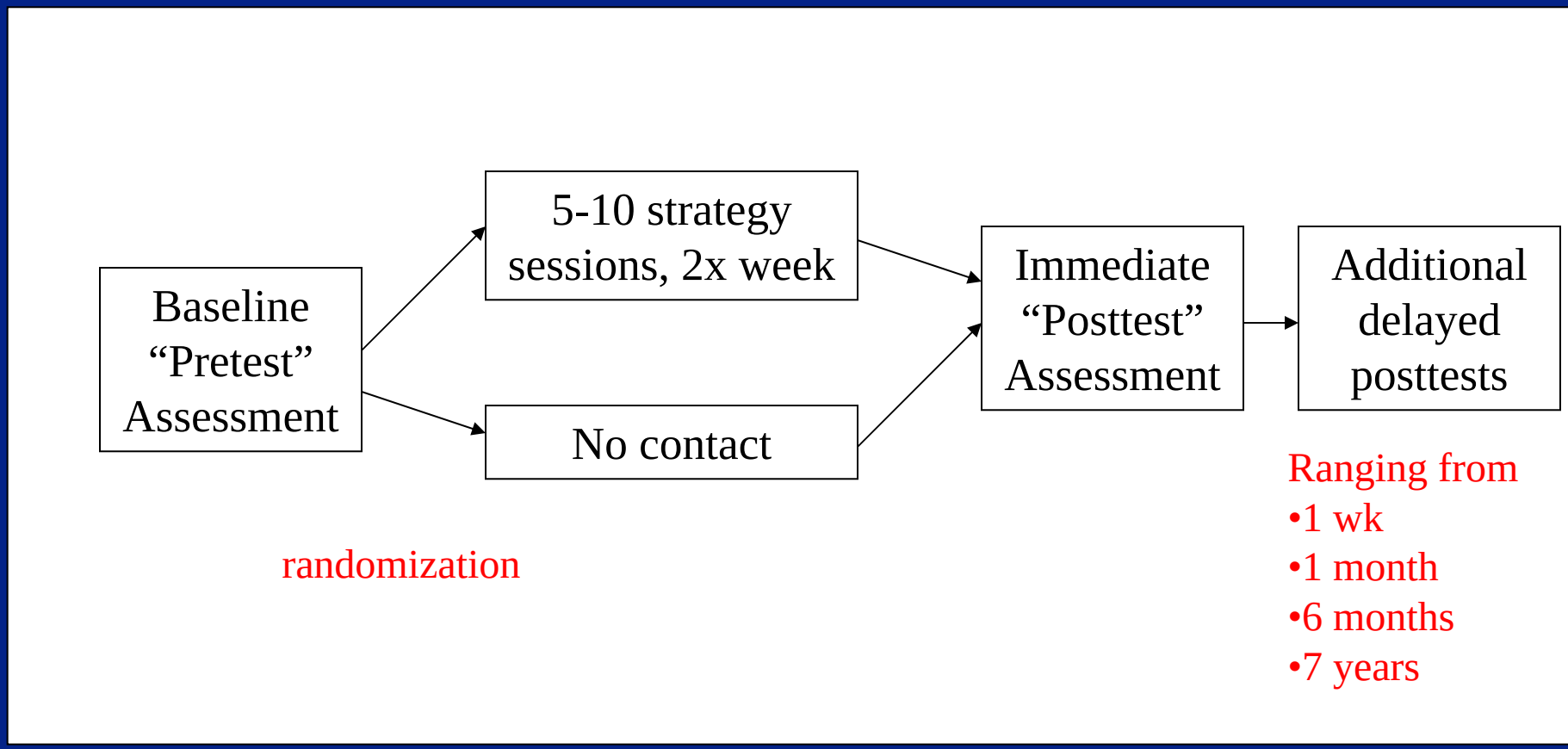
# Useful Field of View




"Selective attention". This test determines the fastest speed at which you can identify whether the central target (here: car) AND identify the location of a "peripheral" target (here: say 2 o'clock) in visual clutter. Again, scores reflect the fastest speed at which you achieve 75% accuracy, and will range from 16 ms (limits of the system) to 500 ms (time out).

# Reasoning training

# Prototypical design of reasoning training studies



# Evaluative criteria

- We typically evaluate these studies by three criteria
  - Magnitude of effect
  - Breadth of effect (training transfer)
  - Durability of effect

# Reasoning training

- Participants have tended, at enrollment, to be young, healthy older adults

| Study | Year | Mean Age (Range) |
|---|---|---|
| Plemons, Willis & Baltes | 1978 | 69.5 (59-85) |
| Willis, Blieszner & Baltes | 1981 | 69.8 (61-81) |
| Blieszner, Willis & Baltes | 1981 | 70.3 (60-85) |
| Willis, Cornelius, Blow & Baltes | 1983 | 70.5 (62-84) |
| Willis & Schaie; Schaie & Willis | 1991 | 72.8 (64-95) |
| Baltes, Dittmann-Kohli & Kliegl | 1986 | 72.0 (60-86) |
| Baltes, Kliegl, & Dittmann-Kohli | 1988 | 73.0 (63-89) |
| Baltes, Sowarka, & Kliegl | 1989 | 72.0 (63-90) |
| Hofland | 1981 | 69.2 (60-80) |

# Reasoning studies: Durability

- In most studies, the obtained training effects, though highly specific, appear to last for very long times

| Study | Year | Breadth of transfer | Durability of effects |
|---|---|---|---|
| Plemons, Willis & Baltes | 1978 | Near-near (ADEPT Figural Relations) only | 6 months |
| Willis, Blieszner & Baltes | 1981 | Both trained (Figural Relations) and far-fluid (Inductive Reasoning) abilities show transfer | 6 months |
| Blieszner, Willis & Baltes | 1981 | Near-near (Inductive Reasoning) only | 1 month |
| Baltes, Dittmann-Kohli & Kliegl | 1986 | Near-fluid and far-fluid transfer | Improvement to 1 month; drop by 6 months, but still above immediate posttest levels |

# Other interventions

# Other targets of intervention: Memory

- Memory
  - This line of research tends to be more age comparative, and to feature a wide diversity of tasks and mnemonic strategies to be trained
  - Many examples of training effectiveness (Rebok, Rasmusson & Brandt, 1996; Greenberg & Powers, 1987; Scogin, Storandt, & Lott, 1985; Yesavage, 1985; Kliegl, Smith & Baltes, 1990)
  - Verhaeghen, Marcoen & Goosens (1992) meta-analysis: Pretest to posttest effect size for mnemonic training groups (0.73 SD units) was twice that of placebo groups (0.37 SD units) or control groups (0.38 SD units).

# Other targets of intervention: Memory

- Memory (continued)
  - Verhaeghen, Marcoen & Goosens (1992) meta-analysis: Treatment gains were largest when
    - training was conducted in a group
    - additional memory–related intervention (such as using external memory aids or motivation enhancement) was provided
    - sessions were relatively short
    - participants were younger

# Other targets of intervention: Memory

- Memory (continued)
  - Durability results mixed
    - Maintained effects have been detected from 1 week to six months (Scogin, Storandt, & Lott, 1985; Flynn & Storand, 1990; Sheikh, Hill & Yesavage, 1986; Stigsdotter & Backman, 1989; Stigsdotter Neely, & Backman, 1993; West & Crook, 1992)
    - Other studies have failed to find maintenance (Scogin & Bienias, 1988; Schmitt, Murphy & Sanders, 1981; Wood & Pratt, 1987)
    - Neely and Backman (1995), using a more complex "multifactorial" memory training program, found that trained subjects showed maintenance gains extending to 3.5 years.

# Visual attention training

- An exception to "limited transfer" may be the Useful Field of View, a measure of speeded visual attention
- Participants must perform both central perceptual tasks (identify an object) and note the location of an eccentric/peripheral visual target
- Here, we seem to see transfer to driving related outcomes

# Summary of pre-1996 findings

- The literature has been very clear that cognitive training with older adults, when that training is focused on the enhancement of specific intellectual abilities, produces effects
  - of substantial magnitude,
  - that generalize to multiple markers of the trained ability,
  - that can be very durable, and
  - are typically very specific to the ability trained

# What we didn't know

- Are findings laboratory specific?
- Are positive benefits most likely for European American, advantaged older adults?
  - Does participant status, especially *mental* status, matter?
- Is the durability of different cognitive interventions non-equivalent?
- Do these interventions *matter*? Is there any way we might see transfer to everyday life?

ACTIVE

# Advanced Cognitive Training with Independent and Vital Elders

## A multi-site, longitudinal trial of cognitive interventions with diverse elders

ACTIVE

# ACTIVE

The resultant ACTIVE study differed from prior cognitive training research in several ways:

1. multisite, randomized controlled, single-blind trial
2. analytical approach is intent-to-treat, thereby including all randomized participants rather than only those compliant with the intervention, as in prior research in this field
3. it includes primary outcome measures of everyday functioning
4. the study sample is more socioeconomically and racially diverse than in prior intervention studies

# ACTIVE Sites and Principal Investigators

- **University of Alabama-Birmingham**
  *Karlene Ball, Ph.D.*
- **Hebrew Rehabilitation Center for Aged, Boston**
  *John Morris, Ph.D.*
- **Indiana University**
  *Fred Unverzagt, Ph.D.*
- **Johns Hopkins University**
  *George Rebok, Ph.D.*
- **Pennsylvania State University**
  *Sherry Willis, Ph.D.*
- **University of Florida**
  *Michael Marsiske, Ph.D.*
- **New England Research Institutes, Coordinating Center**
  *Sharon Tennstedt, Ph.D.*

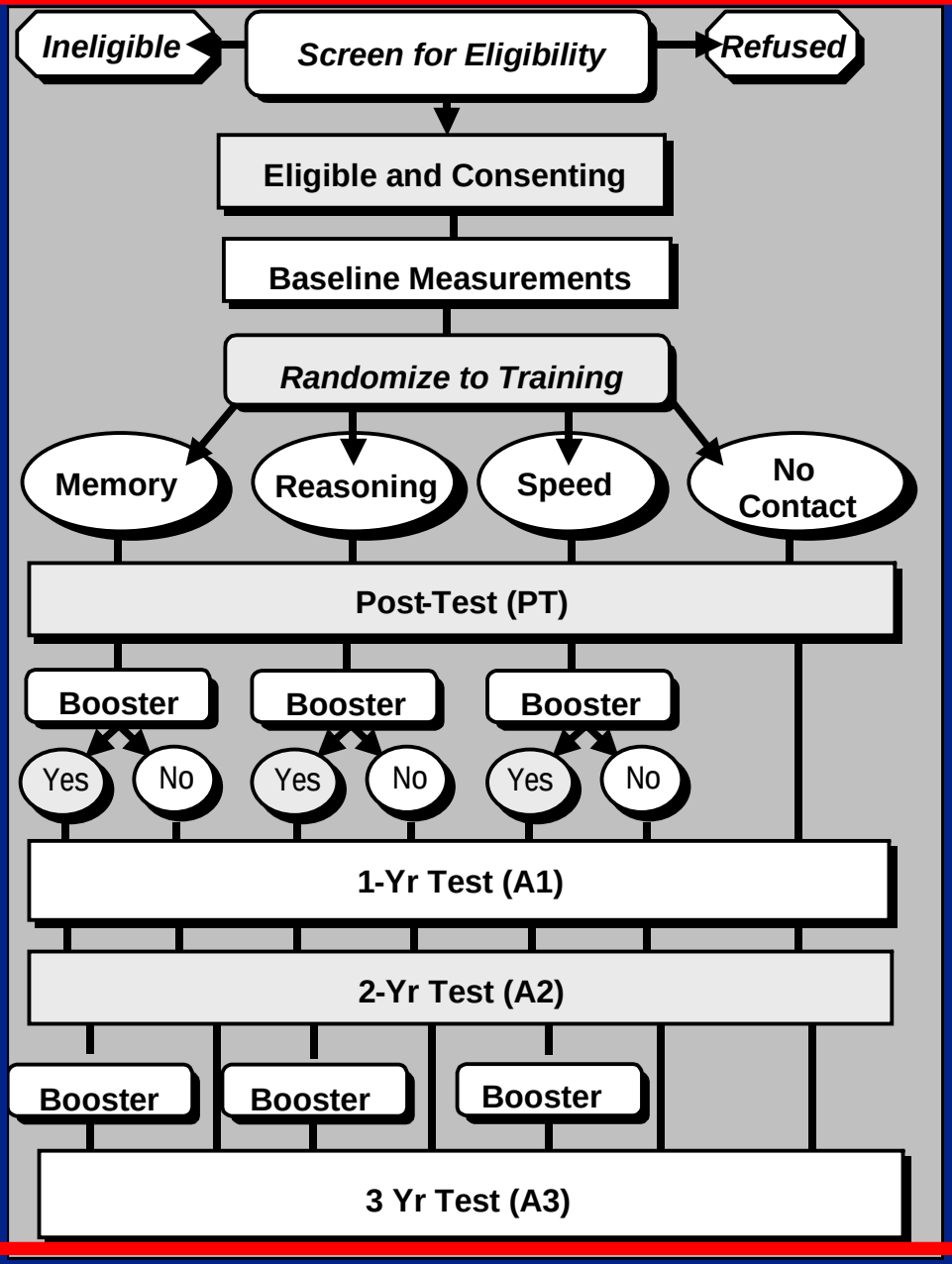
ACTIVE

# Demographic characteristics

| | Ineligible | Not-Randomized | Randomized |
|---|---|---|---|
| N | 855 | 1,312 | 2,832 |
| Women | 77% | 79% | 76% |
| Age, years: mean (sd) | 75 (9) | 75 (7) | 74 (6) |
| Oldest old, age 85+ | 15% | 9% | 5% |
| Non-white | 42% | 40% | 27% |

ACTIVE

# Does intervening on basic abilities transfer to real-world tasks?




**Study Outcomes include**:

1. Proximal outcomes
   - Reasoning
   - Memory
   - Speed
2. Primary outcomes
   - Everyday problem solving
   - Everyday speed
   - Driving

   ADL/IADL performance
3. Secondary outcomes
   - Service use
   - Health status
   - Life space

*Source:* Jobe et al., 2001

ACTIVE

ORIGINAL CONTRIBUTION

# Effects of Cognitive Training Interventions With Older Adults

## A Randomized Controlled Trial


Karlene Ball, PhD
Daniel B. Berch, PhD
Karin F. Helmers, PhD
Jared B. Jobe, PhD
Mary D. Leveck, PhD
Michael Marsiske, PhD
John N. Morris, PhD
George W. Rebok, PhD
David M. Smith, MD
Sharon L. Tennstedt, PhD
Frederick W. Unverzagt, PhD
Sherry L. Willis, PhD
for the ACTIVE Study Group



**Context** Cognitive function in older adults is related to independent living and need for care. However, few studies have addressed whether improving cognitive functions might have short- or long-term effects on activities related to living independently.

**Objective** To evaluate whether 3 cognitive training interventions improve mental abilities and daily functioning in older, independent-living adults.

**Design** Randomized, controlled, single-blind trial with recruitment conducted from March 1998 to October 1999 and 2-year follow-up through December 2001.

**Setting and Participants** Volunteer sample of 2832 persons aged 65 to 94 years recruited from senior housing, community centers, and hospital/clinics in 6 metropolitan areas in the United States.

**Interventions** Participants were randomly assigned to 1 of 4 groups: 10-session group training for memory (verbal episodic memory; n=711), or reasoning (ability to solve problems that follow a serial pattern; n=705), or speed of processing (visual search and identification; n=712); or a no-contact control group (n=704). For the 3 treatment groups, 4-session booster training was offered to a 60% random sample 11 months later.

**Main Outcome Measures** Cognitive function and cognitively demanding everyday functioning.

**Results** Thirty participants were incorrectly randomized and were excluded from the analysis. Each intervention improved the targeted cognitive ability compared with baseline, durable to 2 years ($P<.001$ for all). Eighty-seven percent of speed-, 74% of reasoning-, and 26% of memory-trained participants demonstrated reliable cognitive improvement immediately after the intervention period. Booster training enhanced training gains in speed ($P<.001$) and reasoning ($P<.001$) interventions (speed booster, 92%; no booster, 68%; reasoning booster, 72%; no booster, 49%), which were maintained at 2-year follow-up ($P<.001$ for both). No training effects on everyday functioning were detected at 2 years.

**Conclusions** Results support the effectiveness and durability of the cognitive training interventions in improving targeted cognitive abilities. Training effects were of a magnitude equivalent to the amount of decline expected in elderly persons without dementia over 7- to 14-year intervals. Because of minimal functional decline across all groups, longer follow-up is likely required to observe training effects on everyday function.



*JAMA. 2002;288:2271-2281* www.jama.com


Nearly half of community-dwelling persons aged 60 years and older express concern about declining mental abilities.[1] Although there is substantial evidence that many cognitive abilities and processes are related to measures of functional status, need for care, and quality of life, few studies have addressed whether improving cognitive functions might have short- or long-term effects on activities related to living independently. Interventions designed to delay or prevent the need for nursing homes, home care, and hospital stays can save health care costs, while also ensuring the independence and dignity of the aging population.

A growing body of research supports the protective effects of late-life intellectual stimulation on incident dementia.[2-6] Recent research from both human and animal studies indicates that neural plasticity endures across the lifespan, and that cognitive stimulation in the environment is an important predictor of enhancement and maintenance of cognitive functioning,


**Author Affiliations and Financial Disclosures** are listed at the end of this article.
**Members of the ACTIVE Study Group** are listed at the end of this article.
**Corresponding Author and Reprints:** Karlene Ball, PhD, Center for Research on Applied Gerontology, University of Alabama at Birmingham, 924 19th St S, 101 Hilley-Ahearn Bldg, Birmingham, AL 35294-2100 (e-mail: kball@uab.edu).



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department of Clinical and Health Psychology

College of Public Health and Health Professions

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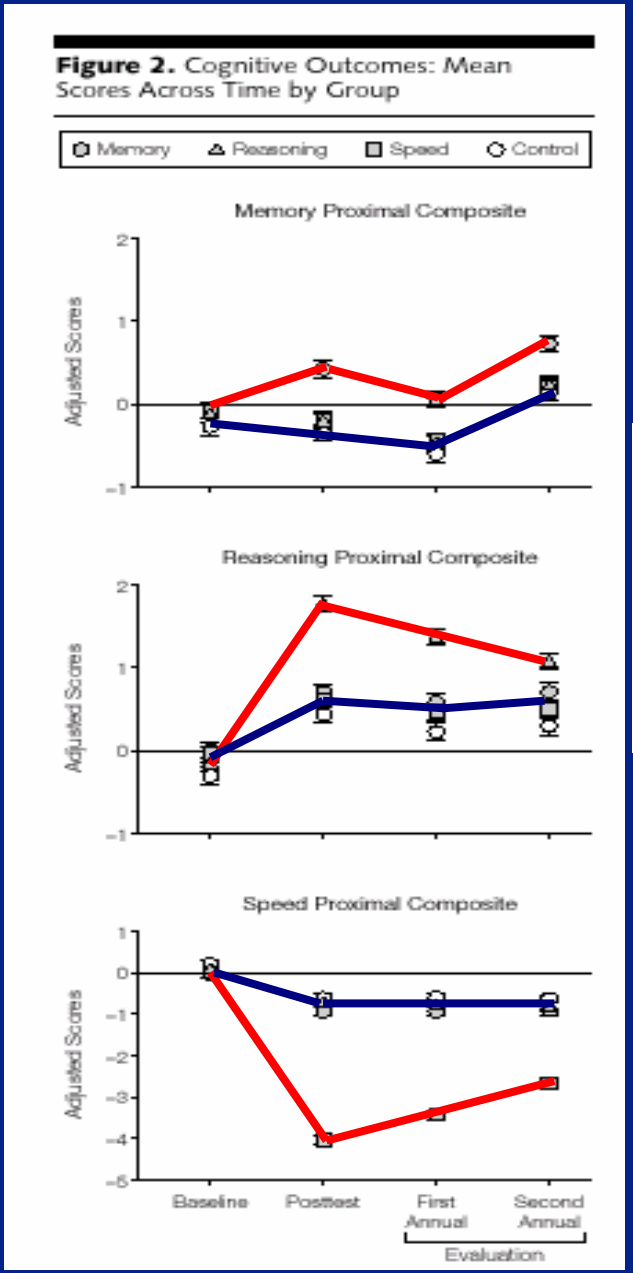
- Overall, this large-scale intervention study (2,802 persons aged 65-96) demonstrated that cognitive interventions helped normal elderly perform better on multiple measures of the specific ability for which they were trained
- It did not demonstrate generalization to everyday performance, at least in the initial 2 years
- Although training impact dissipated over the two-year period of followup, it remained statistically significant, a durability which has not been reported in many other studies



# Transfer of training

- Take skill acquisition from one context or set of stimuli, and show that this yields improved performance in some other context or set of stimuli
  - This is the classic goal of education
  - This is the vexing challenge of skill training research
    - Optimized by similarity between trained and transfer task, lots of practice, situated learning

# Optimizing transfer?

- The trial pre-specified that "real world" functioning (e.g., IADLs) should be the primary outcome
- Knowing, from a century of research (e.g, Thorndike, 1905), that this would be difficult, following the terms of the RFA, the outcome battery included multiple measures in two domains of *everyday cognition* that (a) had been shown to be related to trained abilities (often $r = 0.70$ or higher), and (b) had been shown to be related to traditionally measured IADLs
- Training did not demonstrate generalization to everyday performance, at least in the initial 2 years

# Next steps in ACTIVE

- Rebok et al. (2004) reported, at an interim 3-year followup, that there was continued evidence of maintenance for all three interventions
- About half of all trained participants received booster training; such participants are boosted to even higher levels, and also appear to maintain their boosted performance
- A fifth year followup is recently completed, with a manuscript under review, and will address (a) further durability of training, and (b) evidence for real-world transfer

# Next steps in ACTIVE

- Three follow-up applications planned for 2005-2006
  - Continued followup (7th year, 9th year[?])
  - Detailed neuropsychological characterization of the sample
    - Might training outcomes and prior performance serve as useful indicators of changes to come?
    - (Less likely): Any indication of attenuated conversion rates to cognitive impairment due to the "cognitive reserve" added by training
  - Continued intervention (booster training)

# Do we need training? What other strategies might work?

# Reasoning studies: Training/self-training/practice

- Self-administered training is as good as tutor-guided training (Baltes, Sowarka, & Kliegl, 1989)
- Indeed, self-administered training may be more durable than tutor-guided training (Blackburn, Papalia-Finlay, Foye & Serlin, 1988)
- Practice on as few as six Raven's Progressive Matrices items may yield significant improvements, relative to controls (Denney & Heidrich, 1990)

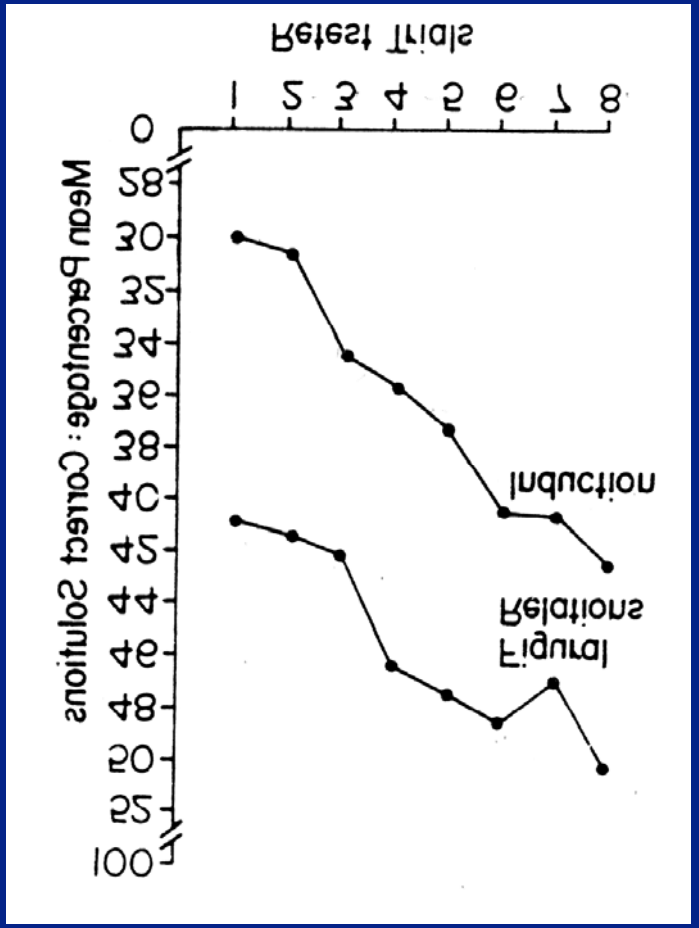
# Decomposing cognitive intervention effects

- Practice

# Practice is highly effective

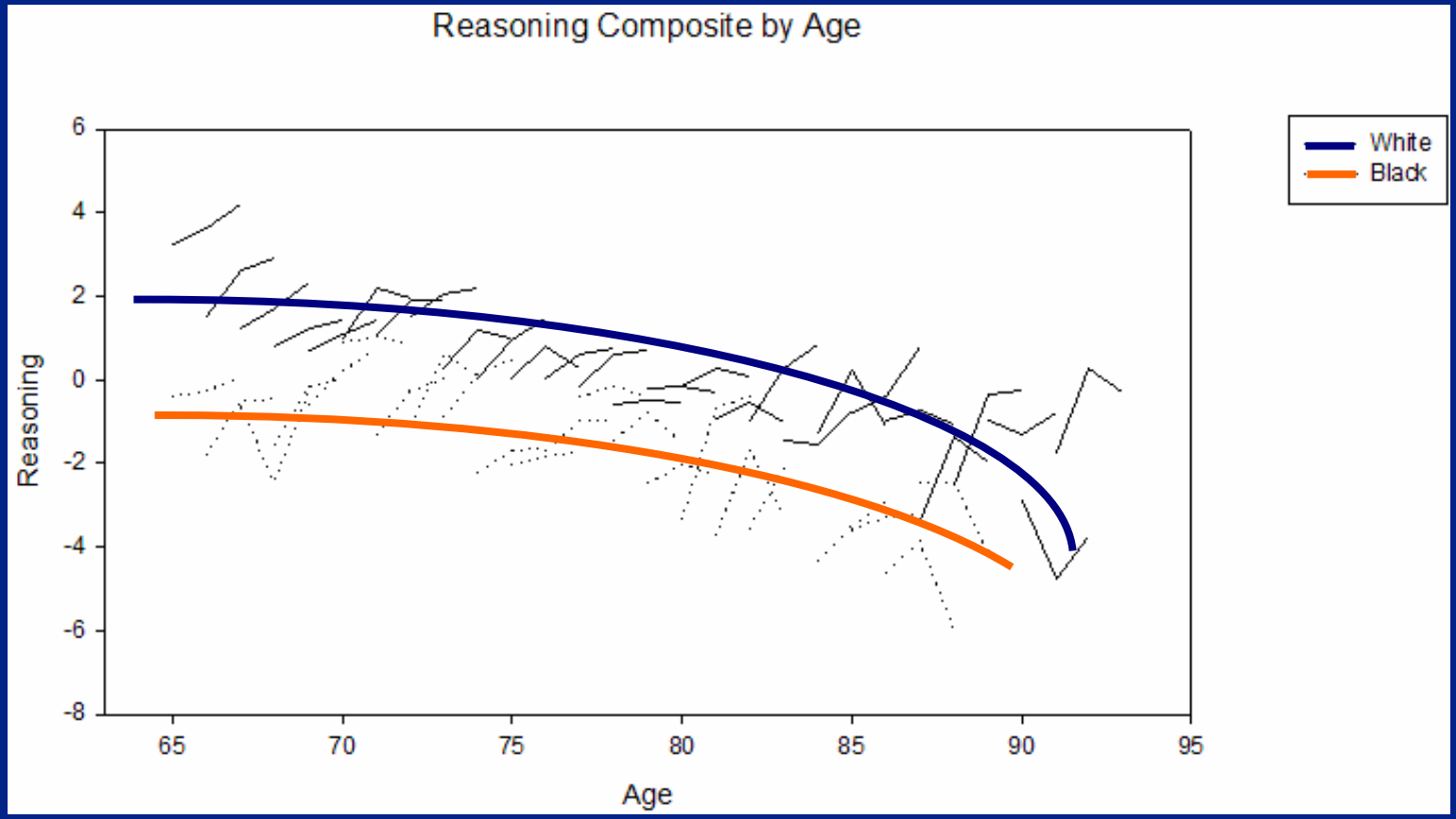
- In the reasoning domain, Hofland (1981; and Hofland, Willis & Baltes, 1981) found little evidence of asymptote, and consistent gain in both Inductive Reasoning and Figural Relations after 8-10 no-feedback practice sessions

*Source:*
Hofland, Willis & Baltes, 1981



ACTIVE

# 3-year retest-gain in several Reasoning measures (ACTIVE control sample)



# Jason Allaire, Ph.D.

Assistant Professor
Psychology
North Carolina State University

MEDLI
Mental Exercise for Daily Living with Independence

# Participants

- Participants
  - 72 participants enrolled at pretest; 58 (14 male, 44 female) remained at posttest, about 36 of whom did twice-daily diaries for 60 days
  - independently living
  - Mean age of survivors = 74 years (range = 60-87 years)
  - Mean education of survivors = 16 years (range = 12 – 22 years)
  - 52 European American, 6 African American

MEDLI
Mental Exercise for Daily Living with Independence

# Daily Mental Exercise

- Participants complete 120 **Daily Mental Exercise Workbooks** on their own in their homes
  - twice a day (morning and night)
  - for 60 consecutive days

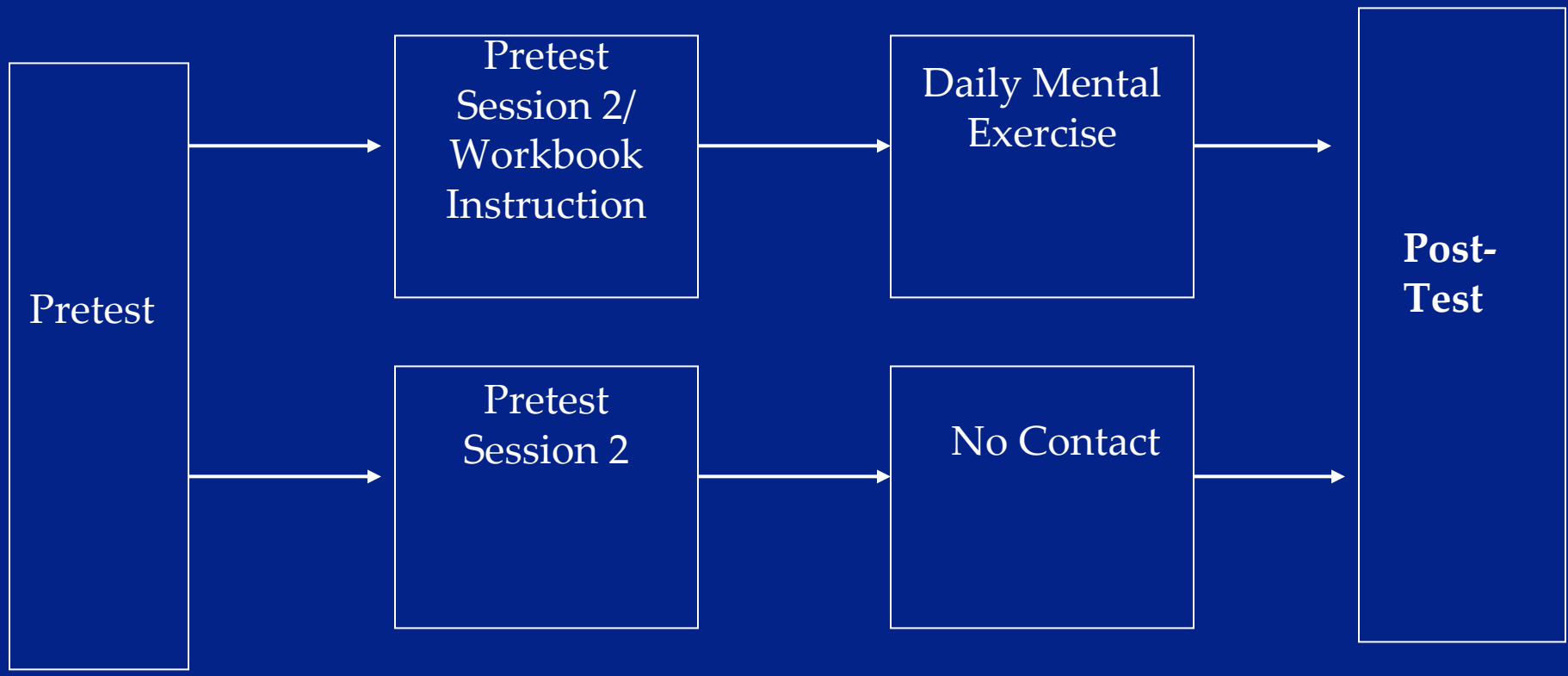
MEDLI
Mental Exercise for Daily Living with Independence

# Content of Daily Mental Exercise Workbooks

- Workbooks include self-administered, timed tests of three cognitive abilities
  - Inductive Reasoning--**Letter Series**
  - Speed of Processing--**Number Comparison**
  - Memory--**AVLT**

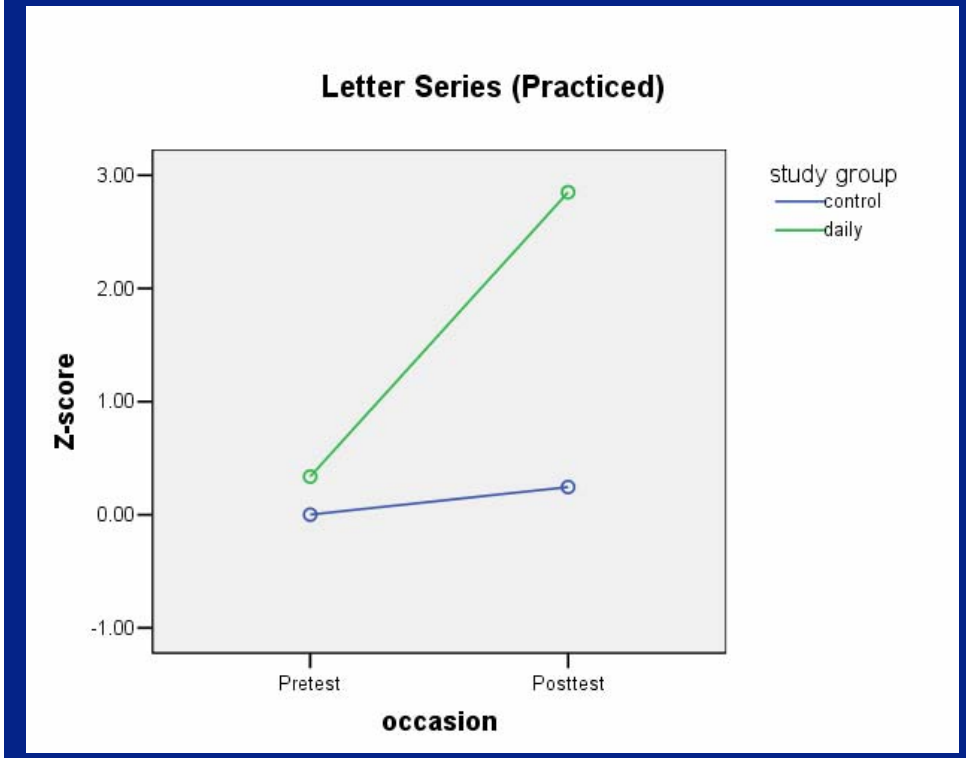
MEDLI
Mental Exercise for Daily Living with Independence

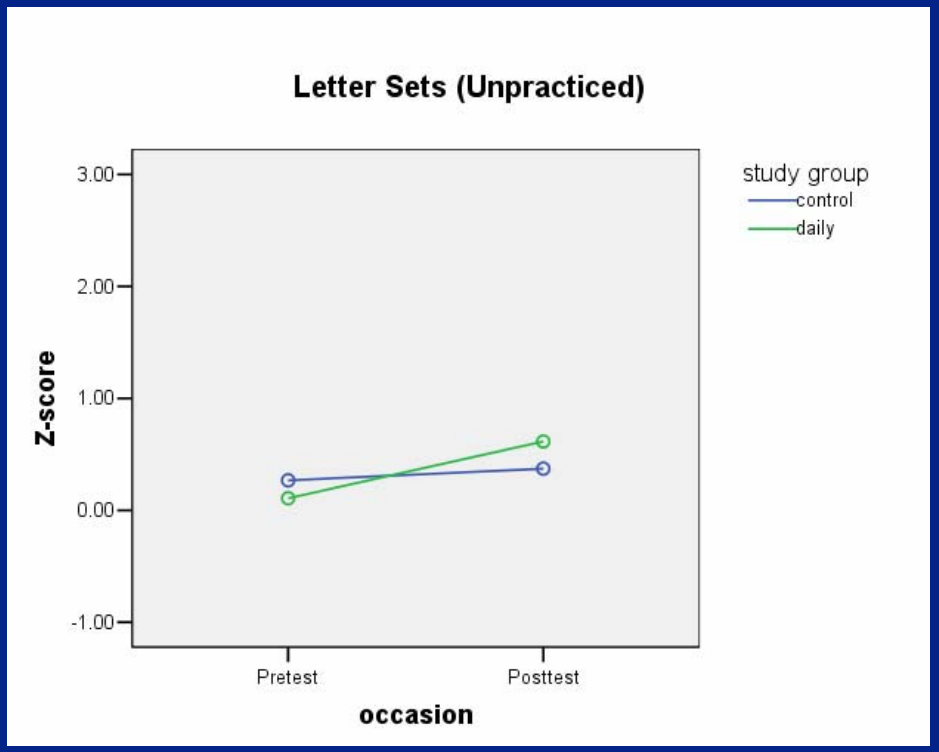
# Design



MEDLI
Mental Exercise for Daily Living with Independence

# Daily Practice Effects: Reasoning



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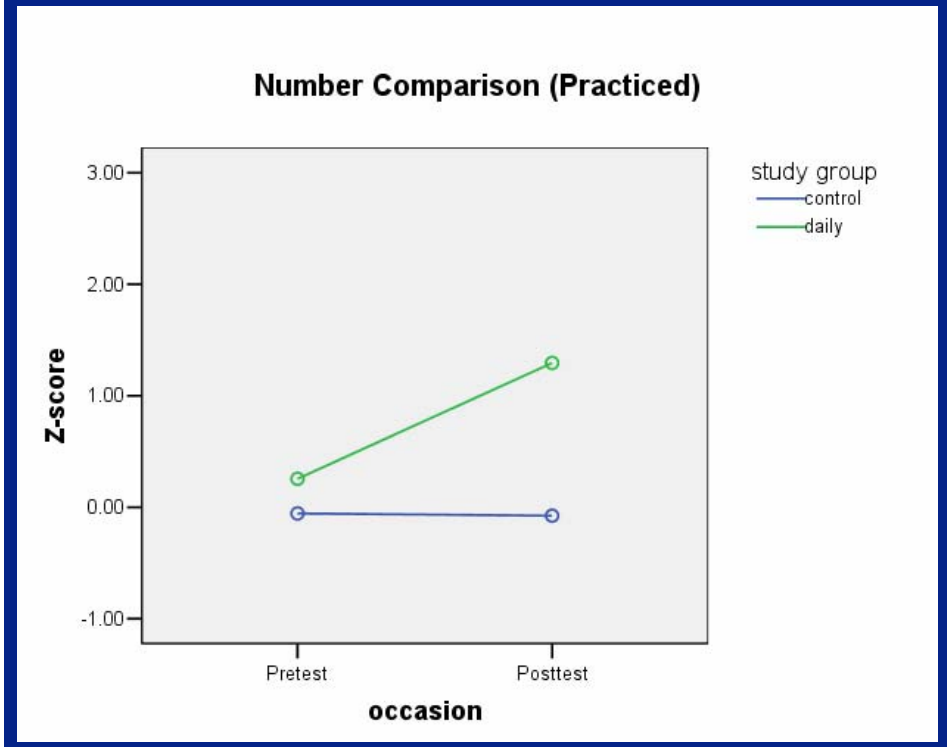
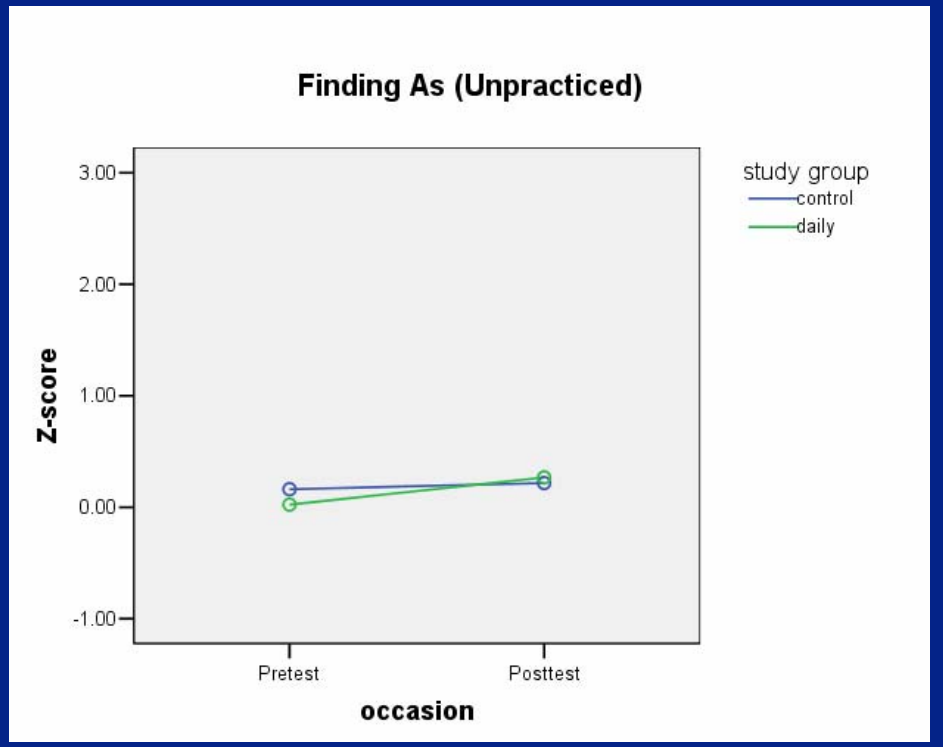
# Daily Practice Effects: Speed



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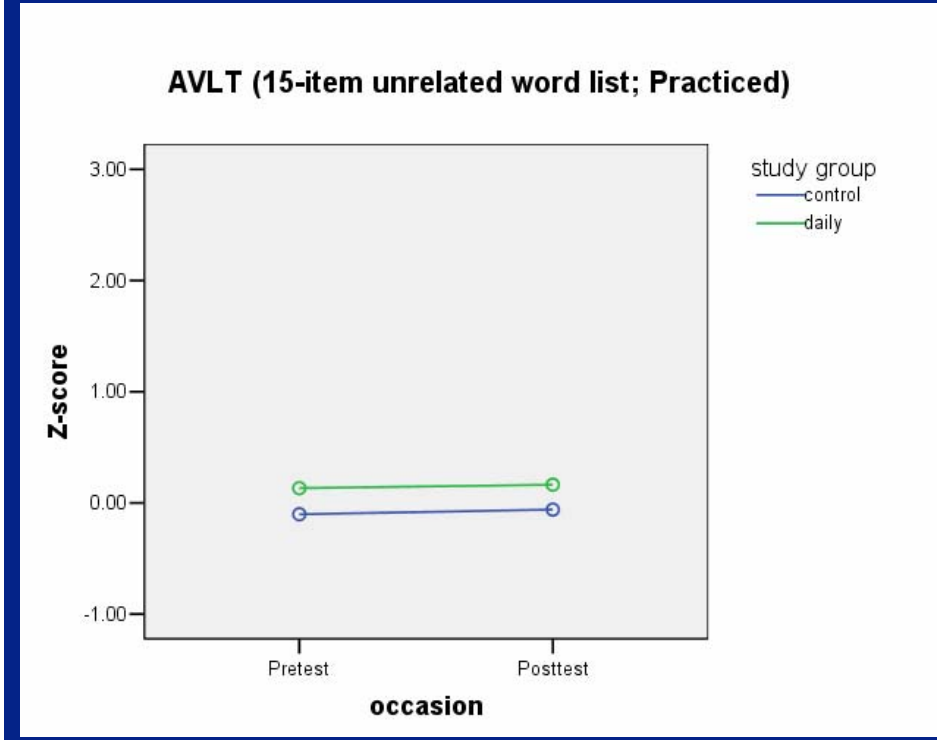
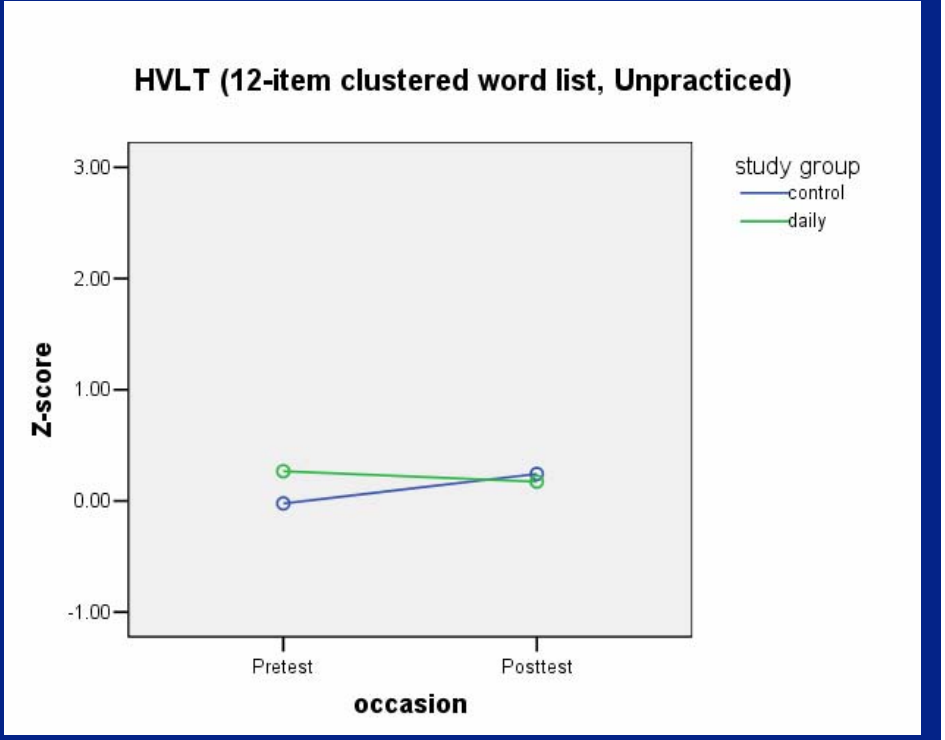
# Daily Practice Effects: Memory



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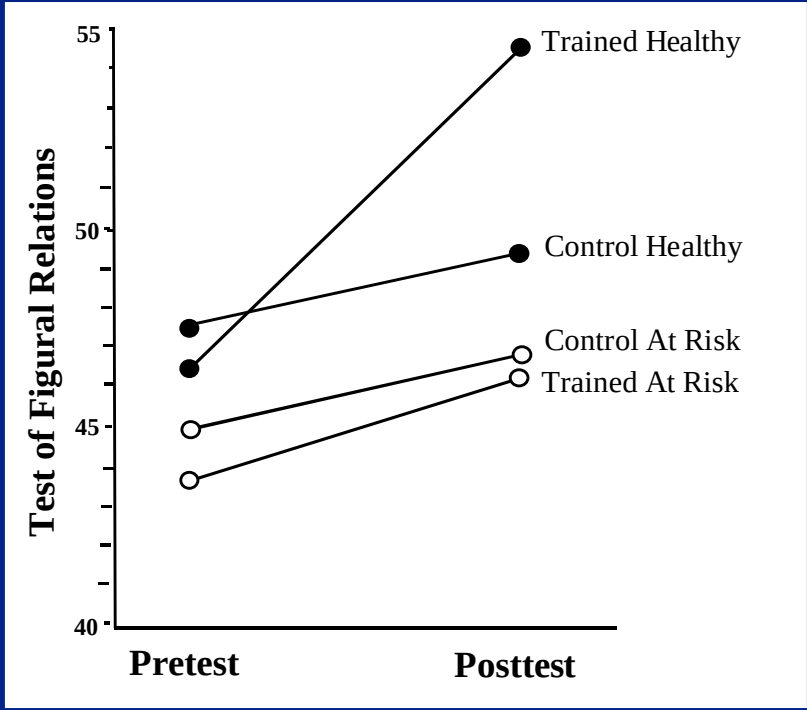
# MEDLI Study

- Huge effects of retest, with little evidence of asymptote (except for Reasoning, and that is likely a ceiling effect problem) after 120 occasions!
- However, the band of transfer is narrower than that reported in any other training or practice study, given these effects
- Simple routine engagement may actually "over-crystallize" task-specific skills

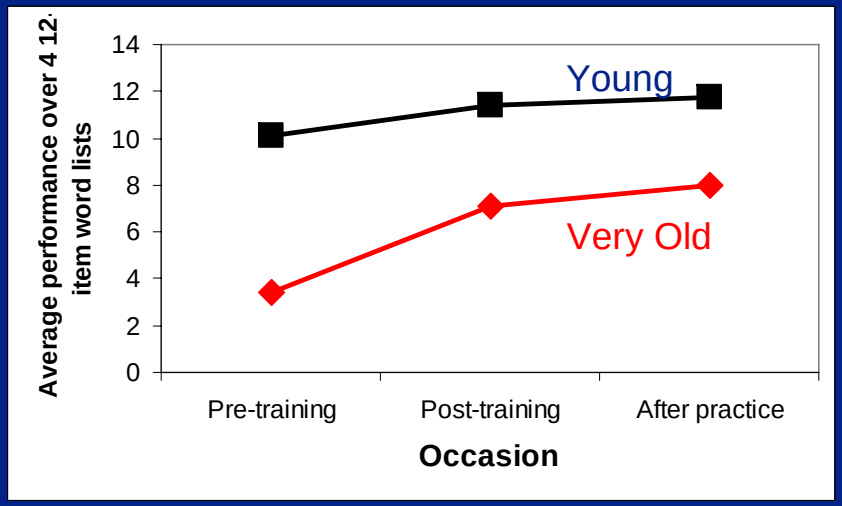
# Cognitive status

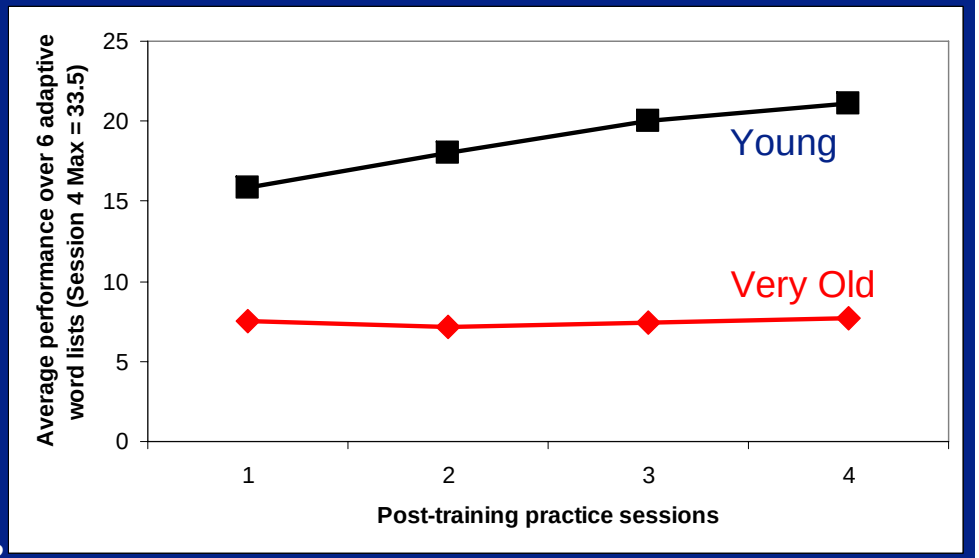
# Cognitive status




M. Baltes, Sowarka & Kuhl (1989) reported that persons at risk for dementia did not show typical training effects in a figural relations training study. Subsequent work showed that posttest gain in inductive reasoning and figural relations rivaled free recall in the prediction of cognitive status.

# Very late life



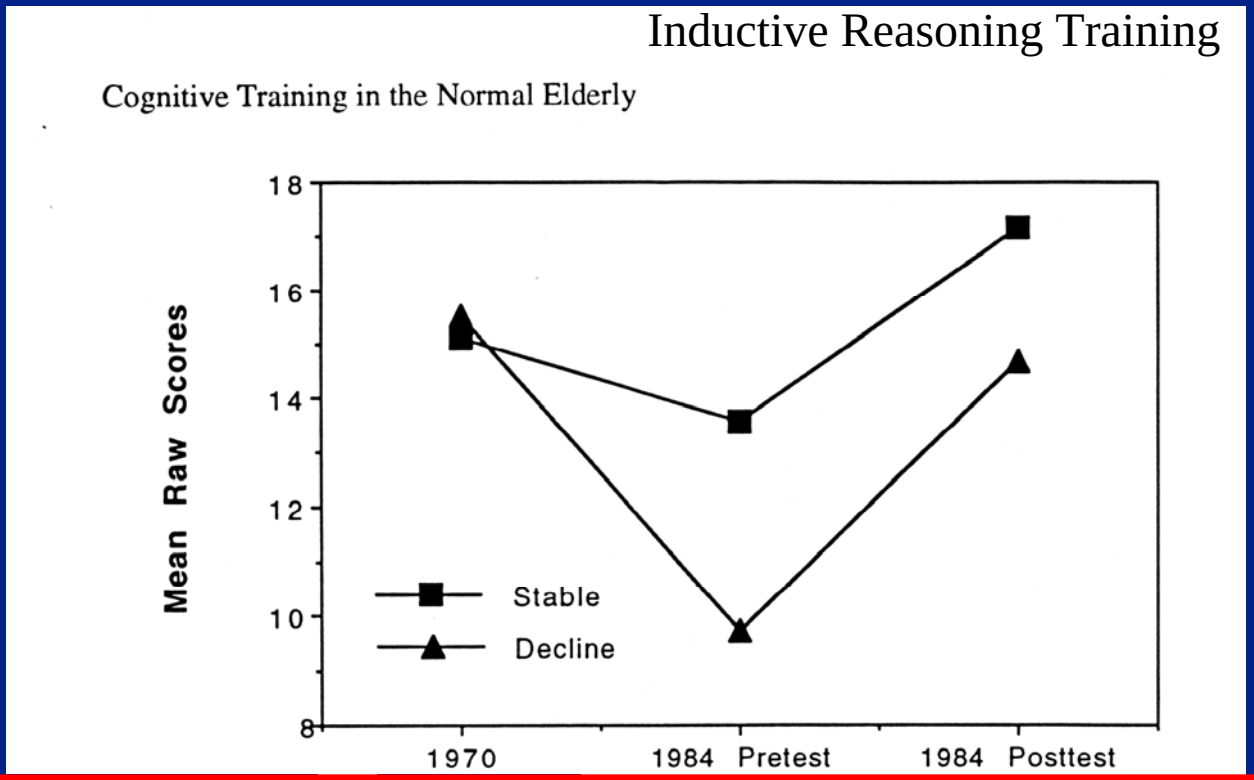

*Data taken from Singer, Lindenberger, & Baltes, 2003*

- Singer, Lindenberger & Baltes, 2003
  - Following Method-of-Loci training, a sample of very old adults (96 participants aged 75+), both age groups improved in free recall. The figure at right shows subsequent gains experienced in post-training practice, with word lists that could grow in length following success; note divergence of age groups.

# Reasoning studies: Cognitive status

- Two groups of participants (those with and without reliable longitudinal decline) received training; gain slopes were roughly parallel, suggesting that training could constitute either "remediation" or "enhancement"

Inductive Reasoning Training




*Source:* Willis & Schaie, 1994

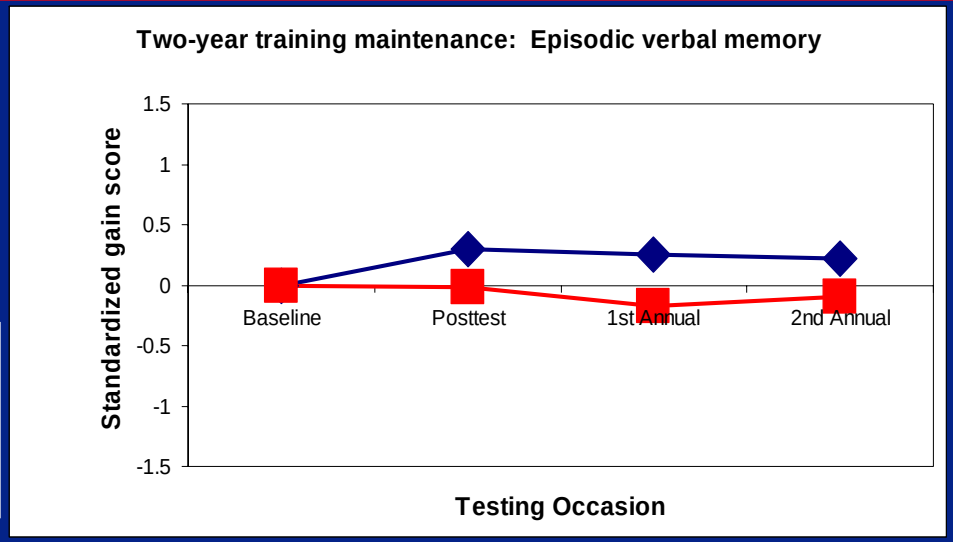
# What about pre-dementia?

- Just as with mild dementia, when samples contain large numbers of *very* old adults, memory-training gains don't seem to occur (Singer et al., 2003)
- What about pre-clinical groups? (e.g., mild cognitive impairment)
- We examined the lowest 5% of baseline memory performers in ACTIVE

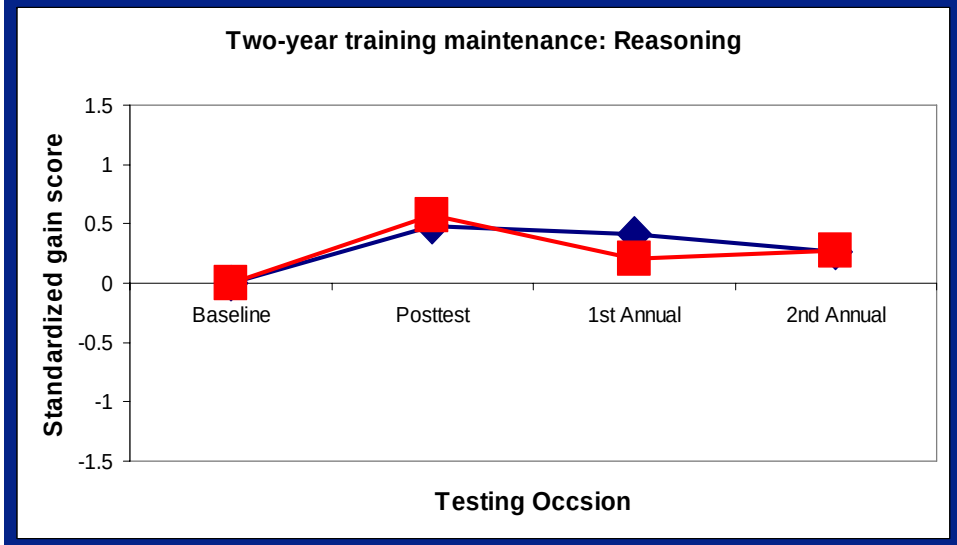
# Subtle differences between amnestic (MCI) and normal elders in training patterns over 2 years

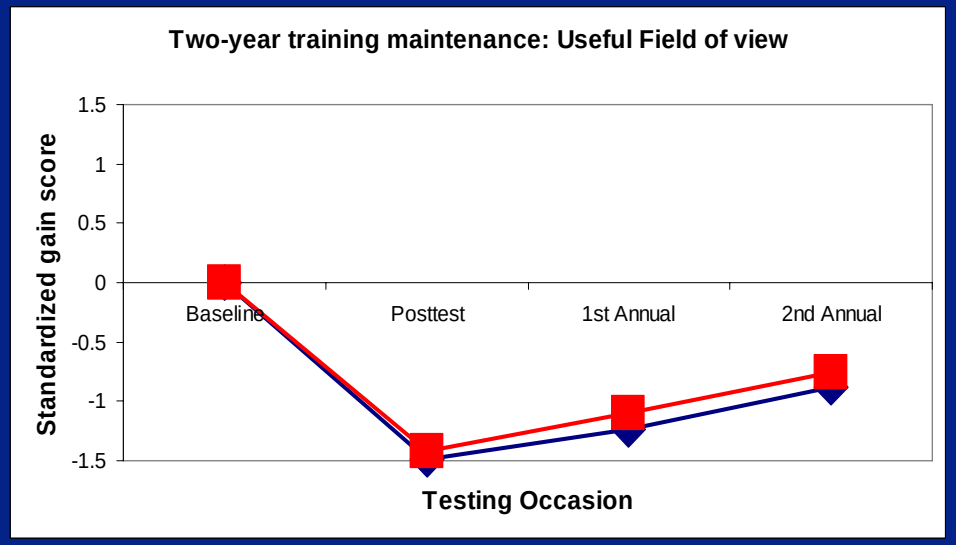
ACTIVE

*Source:* Unverzagt, Marsiske & Kasten, GSA, November 2004







# Karin McCoy, Ph.D.

Post-doctoral fellow
Veteran's Administration
San Antonio, TX

# FitMind Study

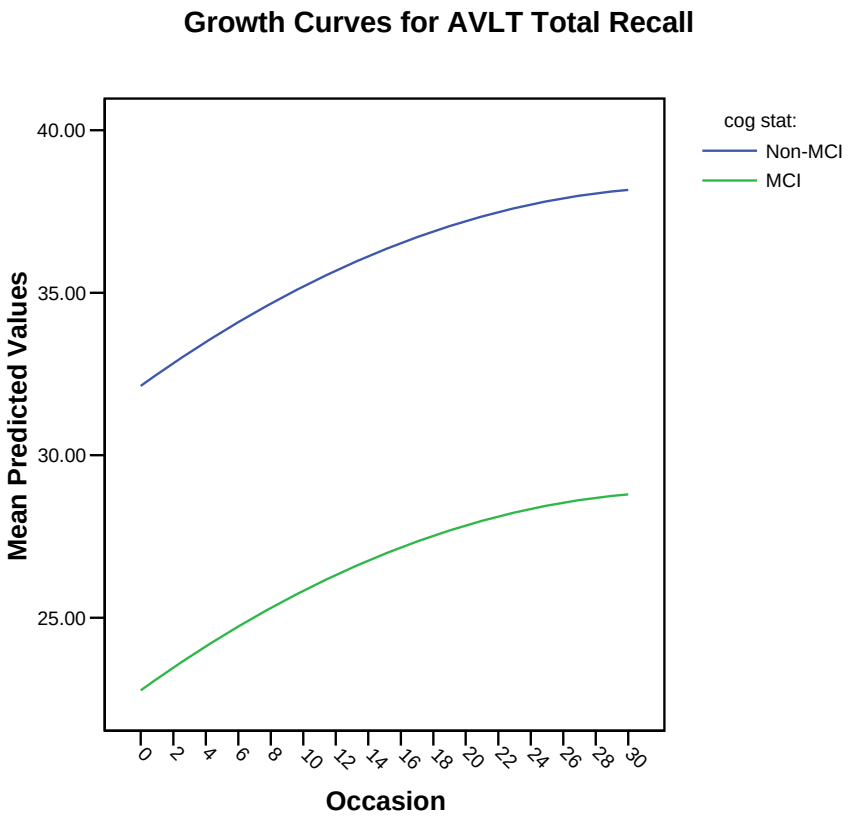
- Another study of ours looked more formally at mild cognitive impairment, (MCI) using clinical consensus criteria for identification of these cases
- One question the study asked was: How does extensive practice (31 occasions) improve performance in those with, and without, MCI?

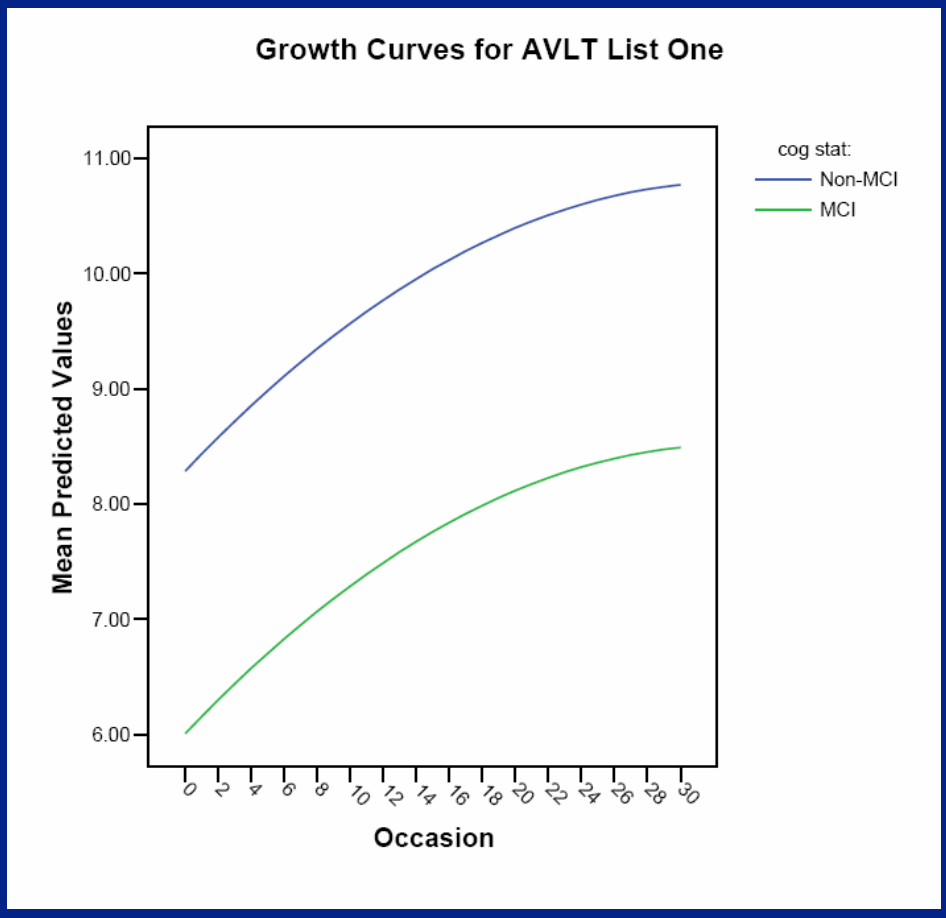
# FitMind Study

- With Karin McCoy (now at VA-Memphis)
- 68 adults with a mean age of 75 years
- 49 were cognitively intact; 17 had amnestic Mild Cognitive Impairment (MCI)
- Focus was again intra-individual variability
- All participants received
- 31 daily trials with measures of list memory (3 repetitions of AVLT-type lists daily), as well as working memory (forward and backward digit span) and perceptual speed/attention (digit-symbols)

THE FITMIND STUDY

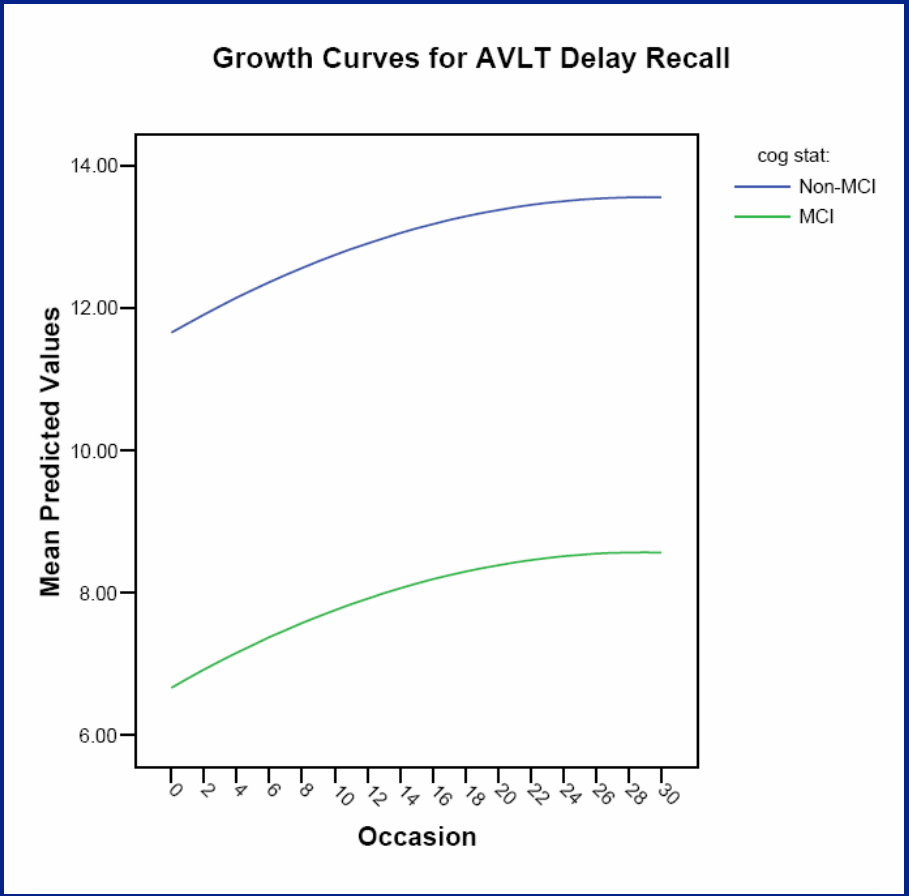
# Equivalent practice related gain, regardless of cognitive status

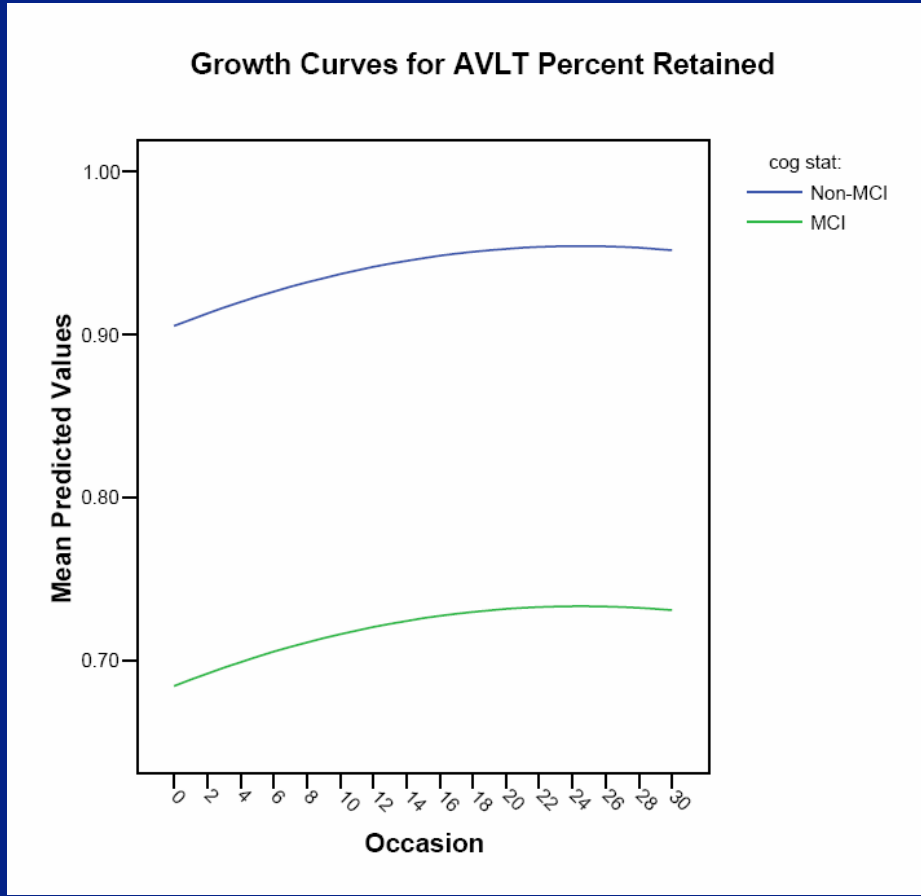


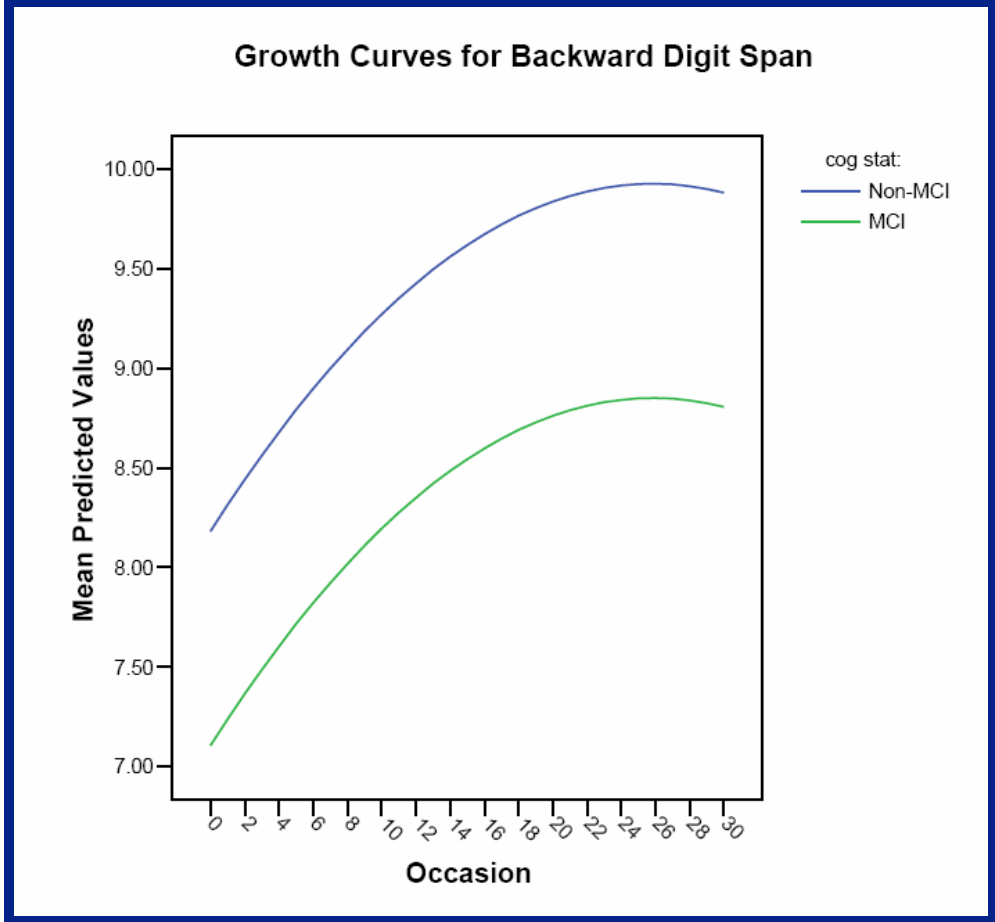

*Source:* Marsiske & McCoy, in preparation

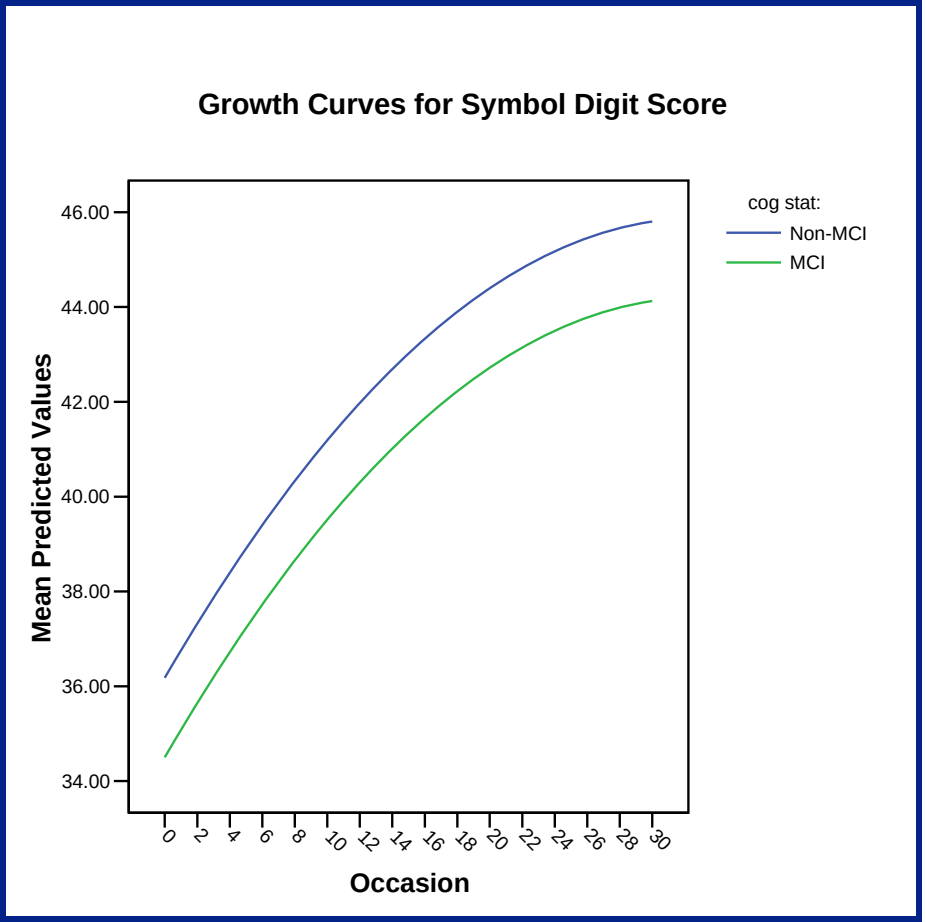
# Equivalent practice related gain, regardless of cognitive status



# Equivalent practice related gain, regardless of cognitive status



# FitMind Study

- Retest effects are large, even for persons with probable incipient cognitive pathology
- Interestingly, however, practice does not appear to help persons with MCI "catch up" in memory
- Again, practice effects are highly specific. Transfer is elusive

# The future?

# Useful Field of View is improved by first-person shooter video games in college-aged players (but not by *Tetris*)

letters to nature

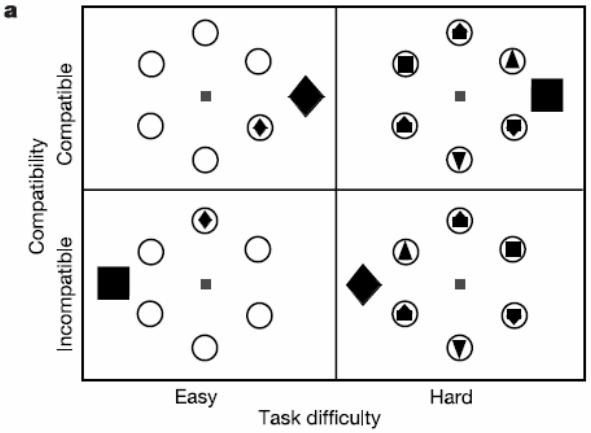
## Action video game modifies visual selective attention

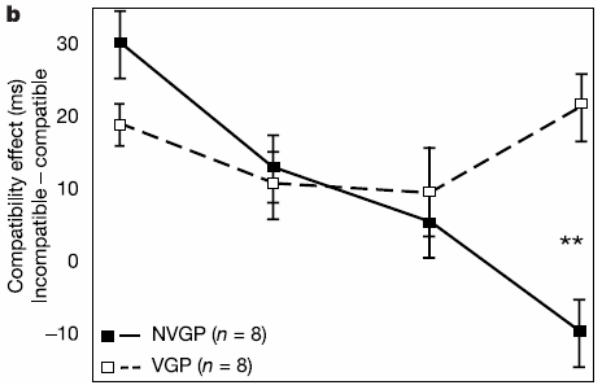
**C. Shawn Green & Daphne Bavelier**

*Department of Brain and Cognitive Sciences, Center for Visual Science, University of Rochester, Rochester, New York 14627, USA*

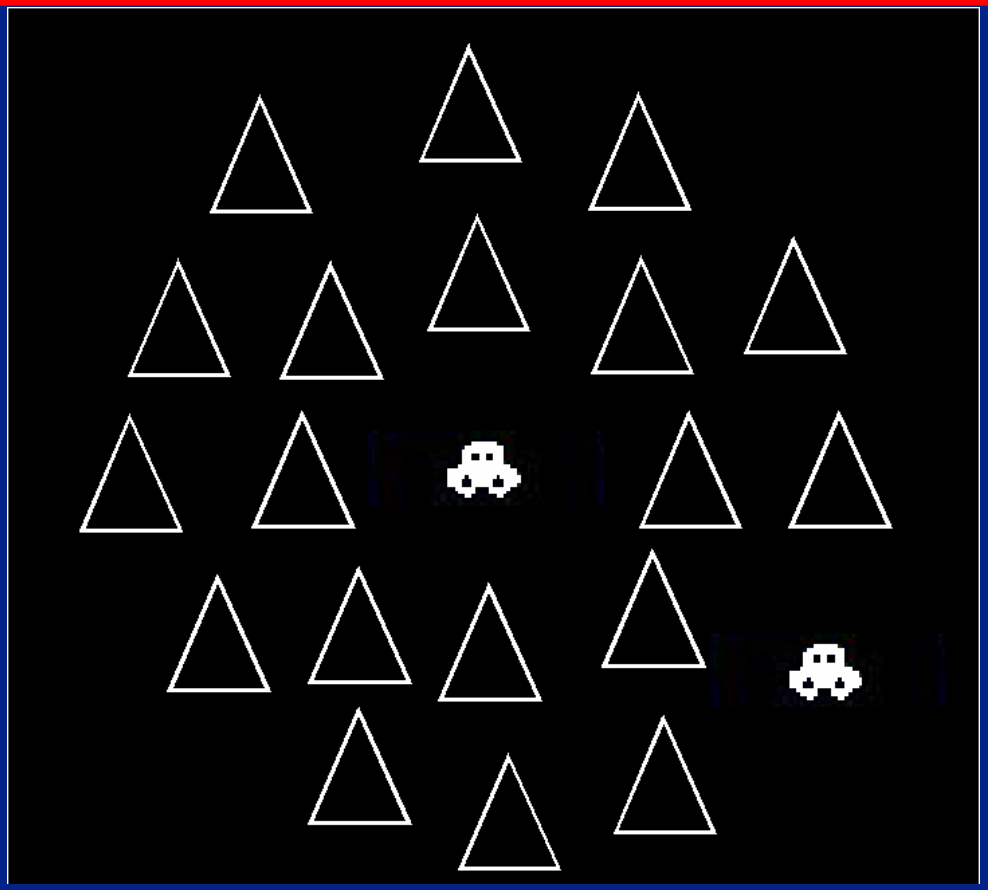
As video-game playing has become a ubiquitous activity in today's society, it is worth considering its potential consequences on perceptual and motor skills. It is well known that exposing an organism to an altered visual environment often results in modification of the visual system of the organism. The field of perceptual learning provides many examples of training-induced increases in performance. But perceptual learning, when it occurs, tends to be specific to the trained task; that is, generalization to new tasks is rarely found[1–10]. Here we show, by contrast, that action-video-game playing is capable of altering a range of visual skills. Four experiments establish changes in different aspects of visual attention in habitual video-game players as compared with non-video-game players. In a fifth experiment, non-players trained on an action video game show marked improvement from their pre-training abilities, thereby establishing the role of playing in this effect.

We first used the flanker compatibility effect, a standard experimental paradigm in attentional studies, to determine whether video-game playing produces an overall increase in attentional

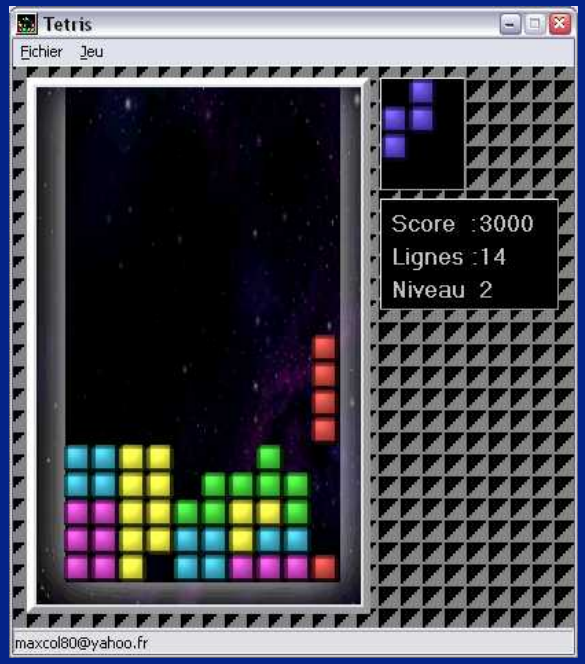


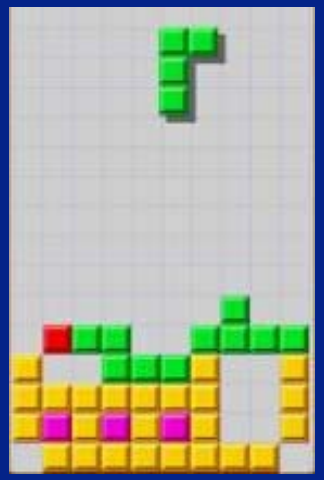



# Useful Field of View



# Tetris


Tetris
Fichier Jeu
Score :3000
Lignes :14
Niveau 2
maxcol80@yahoo.fr



# Medal of Honor



# Exercise

# Questions?